SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

[*The* MINING JOURNAL *is Registered at the General Post Office as a Newspaper, and for Transmission Abroad.*]

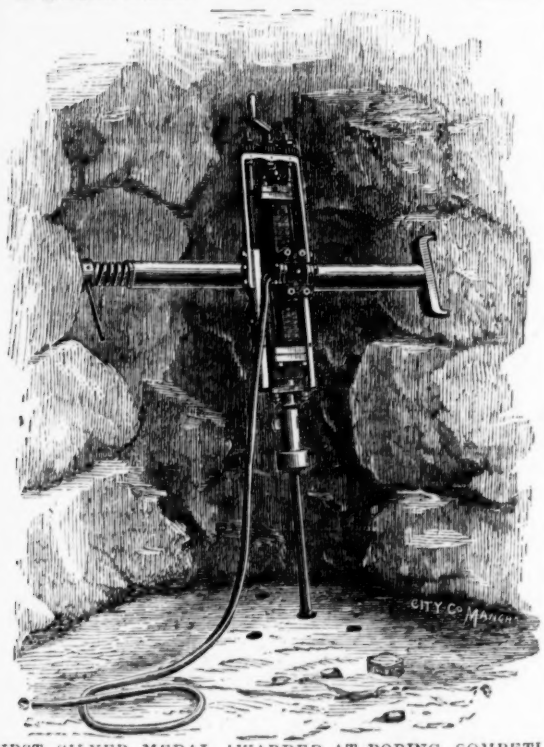
No. 2576.—VOL. LV. LONDON, SATURDAY, JANUARY 3, 1885. PRICE (WITH THE JOURNAL) SIXPENCE BY POST £1 4s. PER ANNUM.

FIRST SILVER MEDAL, ROYAL CORNWALL POLYTECHNIC —Highest Award for Effectiveness in Boring, and Economy in the Consumption of Air.

JUBILEE EXHIBITION, 1882.

THE PATENT

"CORNISH" ROCK DRILL.



FIRST SILVER MEDAL AWARDED AT BORING COMPETITION, DOLCOATH MINE, 1881.

The "CORNISH" ROCK DRILL and "CORNISH" COMPRESSOR

Are now largely in use, and in every case are giving entire satisfaction.

For Testimonials, Illustrated Catalogues and prices, apply to—

HOLMAN BROTHERS,

CAMBORNE FOUNDRY,

MAKERS OF

MICHELL & TREGONING'S PATENT PULVERISER, and HOLMAN'S IMPROVED STEAM or AIR PUMPING and WINDING ENGINE for Underground Quarries or Shallow Mining. Indispensable for Shaft Sinking with Rock Drills. Also makers of all kinds of MINING MACHINERY at

THE CAMBORNE FOUNDRY AND ENGINE WORKS, CAMBORNE, CORNWALL.

THE PATENT

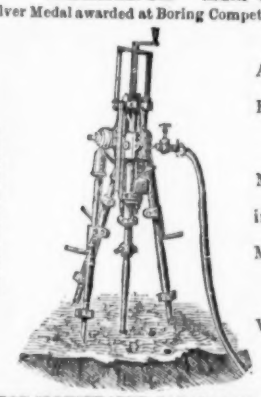
"ECLIPSE" ROCK-DRILL

AND

"RELIANCE AIR-COMPRESSOR."

First Silver Medal awarded at Boring Competition, East Pool Mine, Sept. 1883.

SILVER MEDAL—PARIS, 1878—HIGHEST AWARD



Are NOW SUPPLIED to the ENGLISH, FOREIGN, and COLONIAL GOVERNMENTS, and are also IN USE in a number of the largest MINES, RAILWAYS, QUARRIES, and HARBOUR WORKS in GREAT BRITAIN and ABROAD.

FOR ILLUSTRATED CATALOGUE AND PRICES, apply to—

HATHORN & CO., 22, Charing Cross, London, S.W.

MORDEY, CARNEY, AND CO. (LIMITED),

SHIPBUILDERS, AND MARINE AND GENERAL ENGINEERING WORKS,

DRY DOCKS, NEWPORT, MON.

All kinds of WROUGHT and CAST IRON STRUCTURAL WORK, including Girders, Tanks, Boilers, Colliery Plant, Winding Engines, Iron Coal Wagons, heavy Smith Forgings, Dock Gates and Caisons, and requirements of Harbour and Dock Works, &c., &c.

All Orders executed promptly, and Tenders from Plans and Specifications.

PATENT

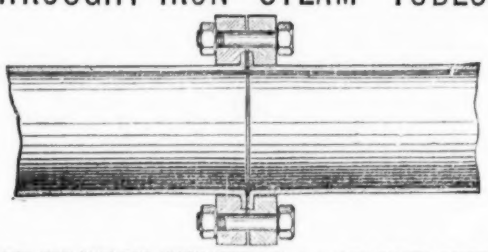
"INGERSOLL ROCK DRILL."

We claim 40 per cent. greater effective drilling power.

MEDAL AND HIGHEST AWARDS.

1872—American Institute.
1873—Ditto.
1874—London International.
1875—Manchester.
1875—Leeds.
1875—Cornwall.
1875—Rio de Janeiro.
1876—Australia.
1876—Philadelphia.
1877—Cornwall.
1877—Mining Institute.
1878—Paris.

WROUGHT-IRON STEAM TUBES.



TUBES FOR BOILERS, PERKINS'S, and other HOT-WATER SYSTEMS.

For Catalogues of Rock Drills, Air Compressors, Steel or Iron Steam Tubing Boiler Tubes, Perkins's Tubes, Pneumatic Tubes, and all kinds of Machinery and MINING PLANT, apply to—

LE GROS, MAYNE, LEAVER & CO.

60, Queen Victoria Street, London, E.C.

GOOD LUCK

The New System for Working Gold, Stream Tin, and Diamond Alluvials.

THE "BALL PATENT."

9, BUSH LANE, CANNON STREET, LONDON, E.C.

THE BALL GOLD SYNDICATE—No. 3.

A small Syndicate is being formed to work a Ball Gold Dredging and Saving Plant on an extraordinary property on the following terms:—The Syndicators find the machinery and the capital to work it—about £2000 at most. They receive back out of gold raised—1. All their expenses.—2. One-sixth of the gold remaining after this deduction.

The concession is rich, inexhaustible, runs for about 50 years, and covers an enormous mileage of a river, in a most healthy climate, within one month from London, with good roads, cheap living, civilised country, and in fact every circumstance conducive to a great success.

CAPITAL HALF SUBSCRIBED.

MACHINERY IN HAND TO LEAVE WITH STAFF IN JANUARY.

FEW SHARES LEFT.

See *Mining Journal*, Nov. 15, 1884, "On Prosperous Gold Mining Enterprise," and Nov. 29, 1884, "Ball Gold Syndicate—No. 3," page 1397.

AIR COMPRESSORS,

With R. SCHRAM'S Patent Inlet and Outlet Valves.

BOILERS, TURBINES.

SCHRAM'S IMPROVED

ROCK DRILL.

1600 in Use in all Parts of the World.

Complete Rock Boring Plants of the most approved construction for Railway Tunnels, Quarries, Shaft Sinking, Level Driving, Stoping, and Submarine Blasting.

All Kinds of Mining Machinery.

ESTIMATES AND FULL PARTICULARS ON APPLICATION.

RICHARD SCHRAM & CO.,

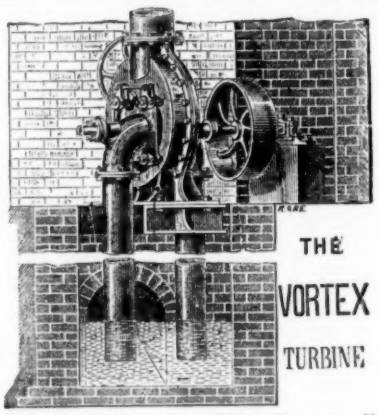
9, NORTHUMBERLAND STREET, CHARING CROSS, LONDON.

GILBERT GILKES & CO.,

KENDAL, ENGLAND,

LATE

WILLIAMSON BROS.



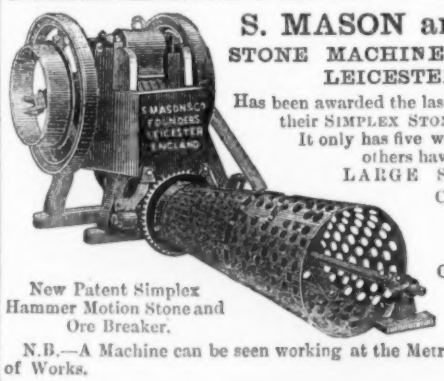
THE VORTEX TURBINE

A most efficient means of applying Water Power to all kinds of Machinery.

Largely used in DRIVING AIR COMPRESSORS, PUMPING, WORKING ORE-CRUSHING MACHINERY, and for other purposes in connection with MINING.

Successfully used in ELECTRIC LIGHTING, and in utilising DISTANT WATER POWER by means of ELECTRICITY.

A Pamphlet containing a full description of the Vortex, with several Illustrations and a number of Testimonials, can be obtained on application.



New Patent Simplex Hammer Motion Stone and Ore Breaker.

S. MASON and Co.,

STONE MACHINE WORKS, LEICESTER,

Has been awarded the last MEDAL for their SIMPLEX STONE BREAKER. It only has five wearing parts; others have 26.

LARGE SIZES.

Can be worked by hand.

Catalogue free on application

N.B.—A Machine can be seen working at the Metropolitan Board of Works.

BELL'S ASBESTOS.

BELL'S PATENT ASBESTOS BLOCK PACKING for High-Pressure Engines

The following testimonials refer to this Packing:—

Mona Lodge, Amlwich, Anglesey,
2nd August, 1884.

DEAR SIR,—I have much pleasure in answering your note. Bad times in mining have compelled me to try all kinds of expedients in order to effect saving; some have succeeded and some have failed, but my underground manager, Capt. Hughes, has just said to me by the telephone—"The Asbestos Packing is the best thing ever brought here."

It saves money and trouble, but like my gas purifying oxide it lasts so long that you must not expect another order from me for twelve months at least.

Yours truly,
T. F. EVANS,
Late H.M. Inspector of Metalliferous Mines.

Mr. J. Bell.

Manchester, Sheffield, and Lincolnshire Railway—Steamship Department,
Grimsby, April 10th, 1884.

DEAR SIR,—I have much pleasure in stating that after a trial of over nine months, and comparing it with other packings, I can confidently recommend your Asbestos Packing. It is especially valuable when high-pressures are employed, as in cases where other packings have perished, owing to high temperatures, your packing has invariably stood well. I have also used it with complete success when a gland has heated with other packings, and also in cases of badly scored piston rods. I consider the results I have obtained by its use for our marine engines to have been in every way highly satisfactory.

Yours truly,
G. H. CLARKE, Sup. Engineer.

Mr. J. Bell.

Department of the Director of Navy Contracts,
Admiralty, Whitehall, 20th June, 1884.

SIR,—I have to inform you that your tender has been accepted for Bell's Rolled Cloth Asbestos Packing to sample submitted:—Elastic core ... ... Square.
" " ... ... Round.

To Mr. John Bell.
JOHN COLLETT, Director of Navy Contracts.

The Patent Block Packing is square, as Fig. 1 and Figs. 2 and 3 represent the Round Block Packing with solid and hollow rubber core, and Fig. 4 without core, but with rubber inlaid. As these packings are extensively imitated, and as it is a common practice among dealers and agents to supply the cheaper manufactures at my list prices, users are requested to see that the packing supplied to them bears the trade mark.

BELL'S ASBESTOS BOILER PRESERVATIVE.—This useful mixture by absorbing the free oxygen that is in the water entirely checks pitting and corrosion. It also disintegrates incrustation so immediately as to prevent its adhering to the plates. Not only is a great economy of fuel effected by keeping boilers clean, but the risk of having the plates burned is thereby obviated. It has been computed that 1/16 in. thick of incrustation causes a waste of 15 per cent. of coal; 1/8 in., 60 per cent.; 1/4 in., 150 per cent. Thus the Preservative avoids the great risks which are inseparable from scaled plates, lengthens the life of a boiler, and covers its own cost a hundred-fold by economy of fuel. It is entirely harmless, and has no injurious action on metals. It can be put into the feed tank or boiler, as may be most convenient. old in drums and casks bearing the Trade Mark, without which none is genuine.

BELL'S ASBESTOS YARN and SOAPSTONE PACKING for Locomotives and all Stationary Engines running at very high speed with intense friction.

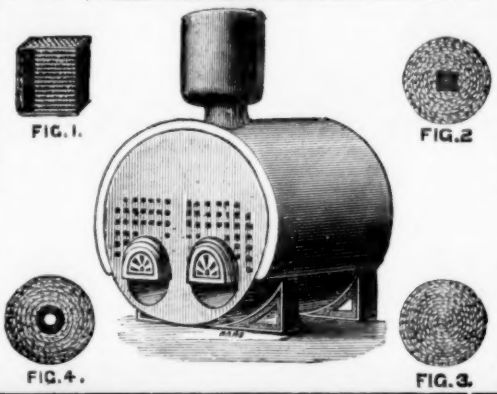
Sandwell Park Colliery, Smethwick, 1st February, 1884.

To Bell's Asbestos Works.

DEAR SIRS,—I have much pleasure in stating that I have used your Asbestos Packing for the last 13 months for our large winding engines which are running night and day, and also for the fan, pumping, and hauling engines at the above Colliery, and during that period we have not used more than one-third the Packing we had formerly; and this I attribute to your Packing on account of its great durability and general excellence of quality.—I am, dear Sirs, yours faithfully,
THOMAS WINTER, Colliery Engineer.

BELL'S ASBESTOS.

The goods of this house are of the highest quality only, and no attempt is made to compete with other manufacturers by the supply of inferior materials at low prices. All "home" orders should be sent direct to the undermentioned depôts and not through Agents or Factors.



BELL'S ASBESTOS BOILER AND PIPE COVERING COMPOSITION, for coating every class of steam pipes and boilers, non-combustible and easily applied when steam is up; adheres to metals and preserves them from rust; prevents the unequal expansion and contraction of boilers exposed to weather; covers 50 per cent. more surface than any other coating, and is absolutely indestructible. It can be stripped off after many years' use, mixed up with 20 per cent. of fresh, and applied again. The composition is supplied dry, and is only to be mixed with water to the consistency required for use.

A Horizontal Boiler, 17 ft. 6 in. long, 15-H.P., gave the following results:—

Temperature on Plates - - - 186 deg.
" Covering - - 94 deg.

One ton of coal was saved per week, and although the fire was raked out every evening 20 lbs. of steam were found in the boiler next morning.

The following Testimonials refers to this Covering:—

Offices of the Wimbledon Local Board, Wimbledon, Nov. 28th, 1883.

DEAR SIR,—It may interest you to know that we save exactly 40 per cent. in fuel through using your covering.

Yours truly,
W. SANTO CRIMP, C.E., F.G.S.

Mr. John Bell, Southwark, S.E.

The Tamar and Kit Hill Granite Company (Limited),
Gunnislake, Tavistock, 8th April, 1884.

SIR,—I have much pleasure in stating that the Asbestos covering applied by you to the boiler of our travelling crane at Kit Hill has yielded most remarkable results. Since it has been in use we have saved fully half our coals, and have effected a great saving in the time it takes to get up steam, which is often a matter of great importance to us. I should add that the crane runs on high gantries, and is fully exposed to all weather. I have formed the highest opinion of your Asbestos as used for this purpose, and as you are aware, have had another boiler similarly covered, though it has not since been used. I can most strongly recommend the material.

I am, Sir, yours faithfully,
W. J. CHALK, Assoc.M.Inst.C.E., Engineer and Manager.

BELL'S ASBESTOS and INDIA-RUBBER WOVEN TAPE and SHEETING, for making every class of Steam and Water Joints. It can be bent by hand to the form required without puckering, and is especially useful in making joints of manhole and mudhole doors. It is kept in stock in rolls of 100 ft., from 1/4 in. to 3 in. wide, and any thickness from 1/16 in. upwards. Manhole covers can be lifted many times before the renewal of the jointing material is necessary. The same material is made up into sheets about 40 in. square, and each sheet bears the Trade Mark, without which none is genuine. It is very necessary to guard against imitations of this useful material, and to secure themselves against being supplied with these inferior articles at my price, users are recommended to see that every 10 ft. length of the Asbestos Tape purchased by them bears the Trade Mark.

BELL'S SPECIAL LONDON-MADE ASBESTOS MILLBOARD, for Dry Steam Joints, made of the best Asbestos fibre, is well-known for its toughness and purity, and is absolutely free from the injurious ingredients frequently used to attain an appearance of finish, regardless of the real utility of the material. Made in sheets measuring about 40 in. square, from 1-64th in. to 1 in., and 1/2 millimetre to 25 millimetres thick. Each sheet bears the Trade Mark.

The following copy of acceptance of tender refers to above:—

Department of the Director of Navy Contracts.
Admiralty, Whitehall, S.W., 17th May, 1884.

SIR,—I have to inform you that your tender for Asbestos Millboard has been accepted.—Mr. John Bell.
JOHN COLLETT, Director of Navy Contracts.

BELL'S ASBESTOS EXPANSION SHEETING (PATENT). This Sheeting is another combination of Asbestos with India-rubber, giving to the steam user the special advantages of both materials. The India-rubber Washer is protected from the action of heat and grease by an outer coating of vulcanised Asbestos Cloth, thus producing an excellent joint where expansion and contraction render other materials unserviceable. This material is admirably suited to steam pipe joints and every class of valve. Valves made of this material are very durable, as they are not subject to injury by oil.

BELL'S "ASBESTOS LUBRICANT"

REGD

ILLUSTRATED PRICED CATALOGUE FREE ON APPLICATION TO

BELL'S ASBESTOS WORKS, SOUTHWARK, LONDON, S. E.

OR THE DEPOTS—118a, SOUTHWARK STREET, S.E.,

Victoria Buildings, Deansgate, MANCHESTER. 11 and 13, St. Vincent Place, GLASGOW. 39, Mount Stuart Square, CARDIFF. 21, Ritter Strasse, BERLIN.

R. S. NEWALL AND CO.,

Sole Patentees of Untwisted Wire Rope.

Iron & Steel Ropes of the highest quality for Collieries, Railways, Suspension Bridges, &c.

PATENT STEEL FLEXIBLE ROPES AND HAWSERS.

IRON STEEL, AND COPPER CORDS. LIGHTNING CONDUCTORS.

COPPER CABLES of high Conductivity for Electric Light and Power.

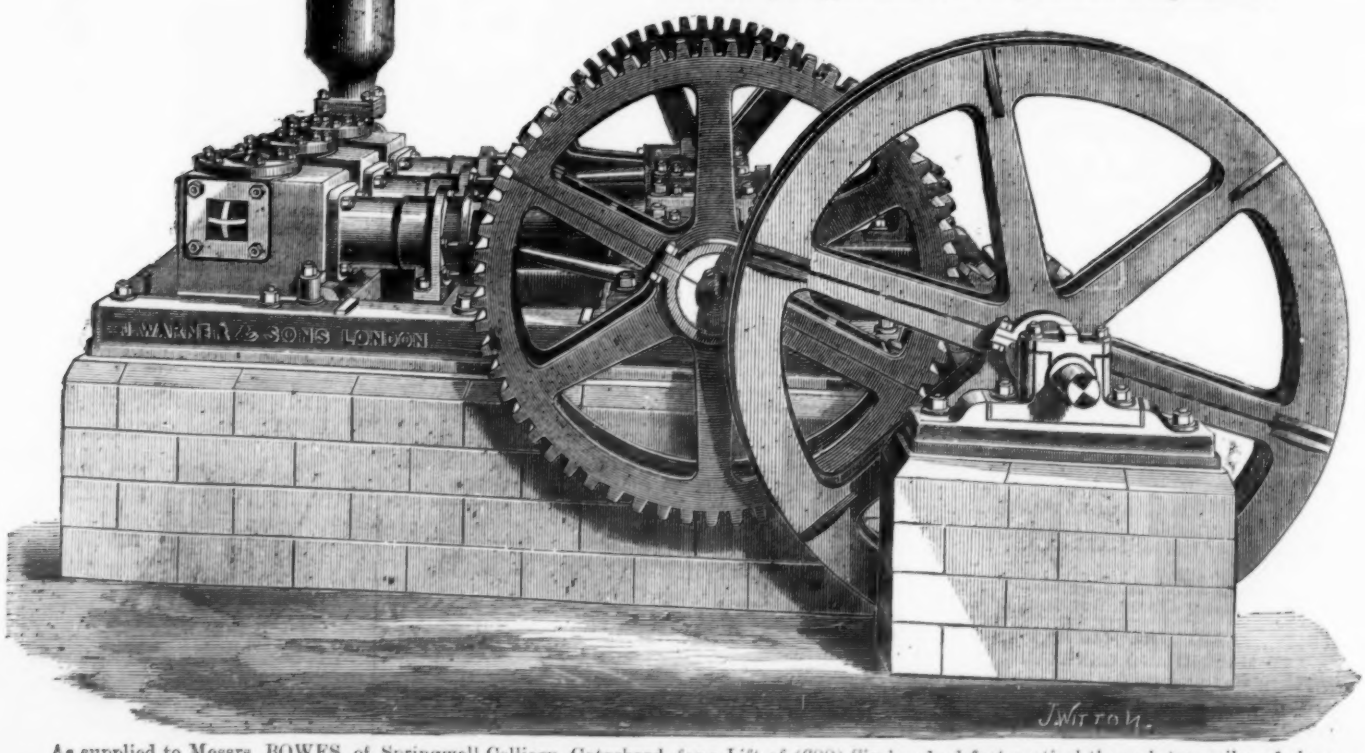
London: 130, STRAND, W.C. Liverpool: 7, NEW QUAY.
Glasgow: 68, ANDERSTON QUAY.
MANUFACTORY: GATESHEAD-ON-TYNE.

WARNER'S TREBLE RAM PUMPS.

To be worked by means of Wire Rope or Gearing.

FOR DEEP MINES OR HEAVY LIFTS, AT LONG DISTANCES.

Prices upon application, with full particulars of requirements.



As supplied to Messrs BOWES, of Springwell Colliery, Gateshead, for a Lift of (600) Six hundred feet vertical through two miles of pipes.

JOHN WARNER AND SONS, THE CRESCENT FOUNDRY, CRIPPLEGATE, LONDON, E.C.

R. HUDSON'S

Patent Steel Trucks, Points and Crossings,

PORTABLE RAILWAY, STEEL BUCKETS, &c., &c.

Telephone No. 14.
In connection with the Leeds Exchange, and all the principal Hotels and places of business in the town.

GILDERSOME FOUNDRY, NEAR LEEDS.

(Near Gildersome Station, G.N.R. Main Line, Bradford to Wakefield and London, via Laisterdyke and Ardsley Junctions.)

Registered Telegraphic Address:—
"GILDERSOME, LEEDS."
A. B. C. Code used.

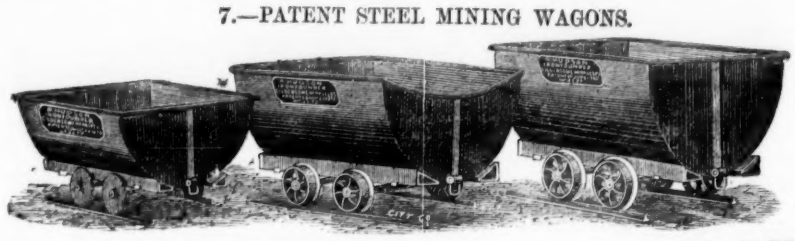
UPWARDS of 25,000 of these Trucks and Wagons have been supplied to the South African Diamond Mines; American, Spanish, Indian, and Welsh Gold, Silver, Copper, and Lead Mines; Indian and Brazilian Railways, and to Railway Contractors, Chemical Works, Brick Works, and Coal and Mineral Shippers, &c., &c., and can be made to lift off the underwork, to let down into the hold of a vessel, and easily replaced. They are also largely used in the Coal and other Mines in this country, and are the LIGHTEST, STRONGEST, and most CAPACIOUS made, infinitely stronger and lighter than wooden ones, and are all fitted with R. H.'s Patent "Rim" round top of wagons, requiring no rivets, and giving immense strength and rigidity. End and body plates are also joined on R. H.'s patent method, dispensing with angle-irons or corner plates.

Patented in Europe, America, Australia, India, and British South Africa, 1875, 1877, 1878, 1881, and 1883.
N.B.—The American, Australian, Indian, and Spanish Patents on Sale.

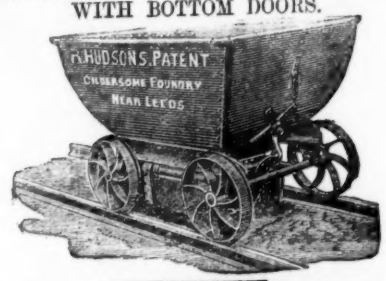
CAN BE MADE TO ANY SIZE, AND TO ANY GAUGE OF RAILS.

1.—PATENT STEEL END TIP WAGONS.

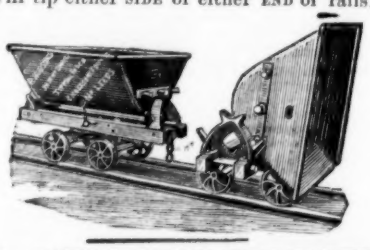
7.—PATENT STEEL MINING WAGONS.



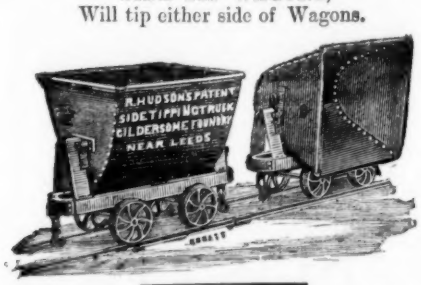
12.—PATENT STEEL HOPPER WAGON, WITH BOTTOM DOORS.



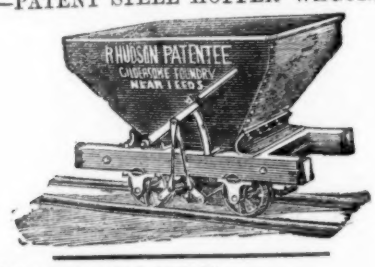
2. PATENT UNIVERSAL TRIPLE-CENTRE STEEL TIPPING TRUCK,
Will tip either SIDE or either END of rails.



8.—PATENT DOUBLE-CENTRE STEEL SIDE TIP WAGONS,
Will tip either side of Wagons.

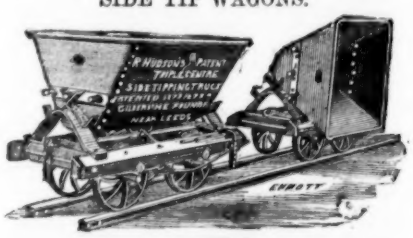


13.—PATENT STEEL HOPPER WAGON.

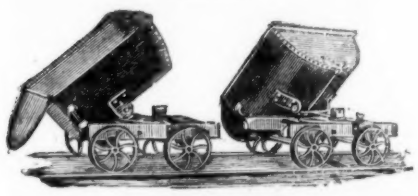


ONE man can EASILY tip ANY WEIGHT in these wagons.

3.—PATENT TRIPLE-CENTRE STEEL SIDE TIP WAGONS.

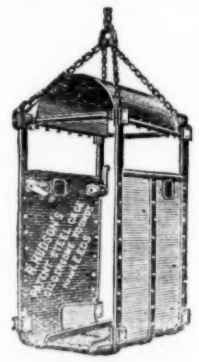


9.—PATENT STEEL ALL-ROUND TIP WAGON.



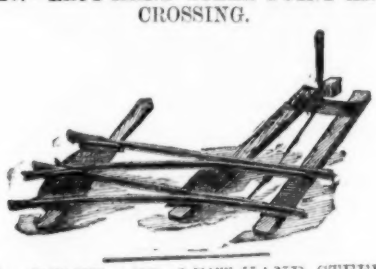
14.—SELF-RIGHTING STEEL TIP BUCKET.
(The "CATCH" can also be made SELF-ACTING if desired.)

15.—STEEL CAGE.

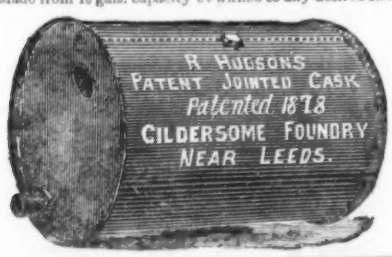


4.—PATENT STEEL PLATFORM OR SUGAR CANE WAGON.

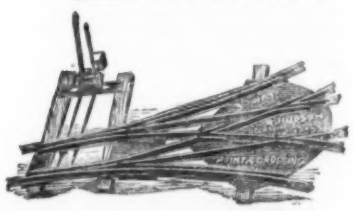
10.—LEFT-HAND STEEL POINT AND CROSSING.



5.—PATENT STEEL CASK.
As supplied to H.M. War Office for the late war in Egypt).
DOUBLE the STRENGTH of ordinary Casks without any INCREASE in weight.
(Made from 10 gals. capacity UPWARDS to any desired size.)



11.—RIGHT AND LEFT-HAND STEEL POINT AND CROSSING.



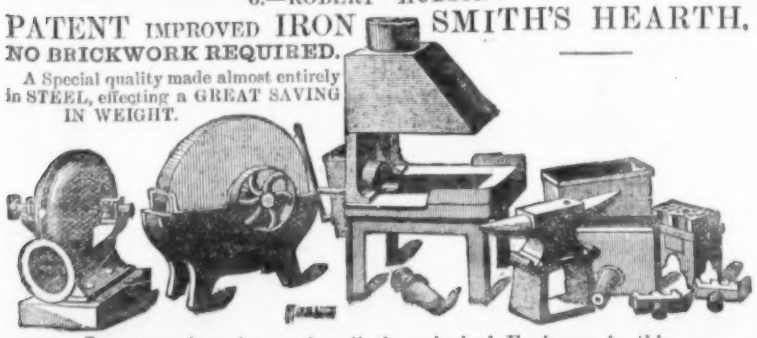
16.—PATENT STEEL WHEELBARROWS.
Made to any Size.
Lightest and Strongest in the Market.

A great success.

17.—STEEL SELF-CONTAINED TURNTABLE.

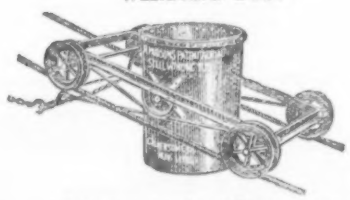
(Also made in CAST Iron for use where weight is not a consideration.

6.—ROBERT HUDSON'S
PATENT IMPROVED IRON & SMITH'S HEARTH,
NO BRICKWORK REQUIRED.
A Special quality made almost entirely in STEEL, effecting a GREAT SAVING IN WEIGHT.



Large numbers in use by all the principal Engineers in this country and abroad.

18.—"AERIAL" STEEL WINDING TUB.



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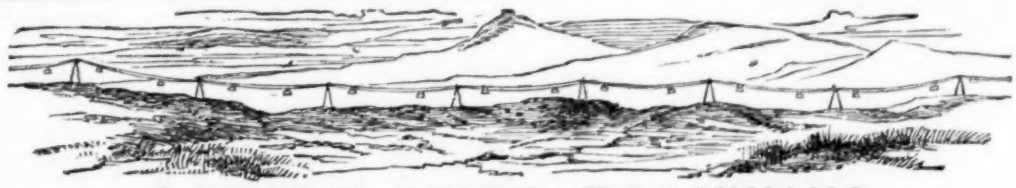

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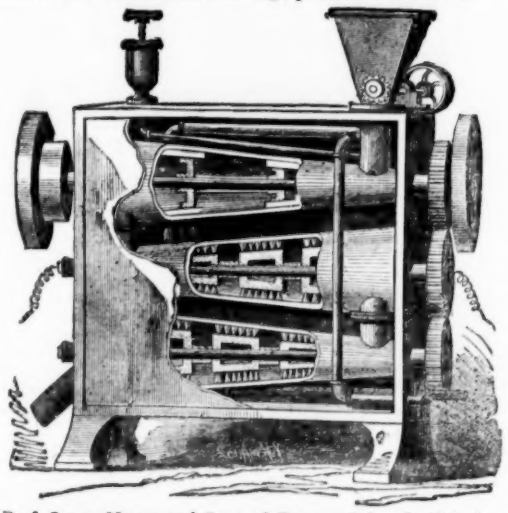
NOVEL ELECTRO METALLURGICAL MACHINE.

PROFESSOR JAMES MANES AND SONS call the attention of miners, mineowners, capitalists, and others interested in the working of gold or silver mines to their new Electro Metallurgical Machine for extracting fine and rusty gold from sands or tailings of stamp mills, or the sands of hydraulic gold diggings, or from the black sands on the coast of Oregon or California, and other parts of the world where gold is found.

The problem that has long troubled the worker of free-milling gold and silver ores is a method to save the mineral now lost in the tailings of stamp mills or flumes. This alone, if it could be saved, would amount to many million dollars profit each year, besides enabling the working of much territory which is now lying idle for want of an economical and thorough process of treatment.



Prof. James Manes and Sons, of Denver, Colorado, U.S., have invented a machine (represented in the above engraving) which it is claimed will save nearly the entire amount of mineral which passes through it, the loss not being over 10 per cent., and in many cases not in excess of half that amount. The machine is a cheap and practical process—it never need stop for charging or cleaning up, being nearly self-acting. Steam, electricity, and mercury are used in the process of extracting the mineral.

This machine or amalgamator is adapted for free-milling gold or silver ores, or refractory after roasting. It consists of a series of three or more large cylinders, wider at one end than the other, placed one above the other in a horizontal position, a shaft or spindle running through the centre of each.

The ore and mercury are fed into the first cylinder, passing into the second, and then to the third. The first cylinder is furnished with steel mullers which nearly touch the sides of the cylinder, and revolve at a good rate of speed, mixing the mercury and ore. The second cylinder is furnished with large steel brushes attached to the shaft or spindle, revolving at a high rate of speed; through this a current of electricity is furnished by a Westinghouse dynamic electro machine, which materially assists in gathering the particles of very fine gold together, and thoroughly amalgamating the metal and mercury. The third cylinder is similarly furnished to the second; into this the amalgam passes, and is again acted upon and mixed by the brushes to catch any gold which might have escaped amalgamation in the second. A fourth cylinder may be used if found necessary.

The amalgamated pulp then passes through a revolving copper drum, plated with quicksilver inside. As the drum revolves it takes up the most part of the amalgamated gold. As the inside of the drum is constantly washed with a spray of water from perforated pipes fixed inside of said drum, a clean-plated surface is constantly brought in contact with the pulp or tailings as it passes out from the cylinders. After leaving the drum it falls down on to incline copper plates, the same as is now used in stamp mills.

The amalgam can be collected from the drum and plates without stopping the machine, and any live quicksilver that passes will be caught in syphons. The tailings are carried off with the water. The machine when attached to the flume will be driven by the waste water; it sifts the fine sands from the coarse gravel, and amalgamates it as above.

The specific points claimed by Prof. Manes and Sons in their patent are—

1.—The saving of almost all the mineral passing through the machine.

2.—The loss being less than 10 per cent.

3.—The entire absence of loss of the amalgamated material, thereby saving all the mercury, which, with the processes now in use, there is a large loss both of mercury and the precious metal.

4.—The small cost per ton at which the ore can be treated.

By the addition of the powerful current of electricity that passes off the revolving brushes, the most minute particles of gold will be caught and retained, which in the ordinary flume and stamps passes off with the water; this often amounts to a large percentage.

The inventors state that if English stock companies will give their assistance to work the black sands of Oregon and California by paying for the building of the machines, they will take a share of the gold for their services, or they will send their machines to any part of the world, or will sell patent rights to those desiring any of their patent machines or revolving furnaces for roasting or smelting ores, ball pulverisers, &c.

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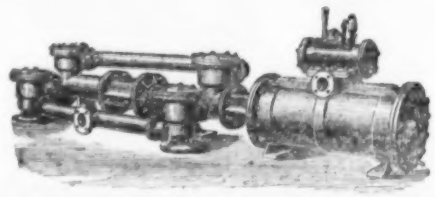

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THE METAL TRADE—ANNUAL REVIEW.

REMARKS.—The year 1884 has been a very disappointing one to all connected with metals. It opened with a range of exceptionally low and unprofitable prices, but it closes with quotations for all metals except quicksilver ruling at much cheaper rates. In the course of the year there have been various features of interest, but perhaps none more striking than the low rates that have been accepted. In some instances prices have touched unprecedently low figures, figures that have never been known before in the history of the trade, figures which have often been more than unprofitable to suppliers and manufacturers, and figures which even the most despondent could not have anticipated in the early months of the year. Speaking generally prices were at their highest in the first month of the year, and at their lowest in the last. Here and there fluctuations may have occurred by which some metals may have temporarily touched higher or lower figures than at the times we have mentioned, but that has been merely a market fluctuation, and metals, as a whole, have continued to depreciate in value throughout the year. As might have been expected these reduced rates have in many instances been the means of enormously increasing the consumption. Deliveries of a few metals have swelled to a considerable extent, far more than the most sanguine could have expected, a feature very satisfactory in face of the extremely bad state of general trade during the whole year. In most metals there has been no room for complaiut of the actual amount of business transacted; it has been at times extremely large. The deliveries which from time to time announced have invariably been large, in some months larger than they have ever been known before, but notwithstanding this there are few who are satisfied with the result of the year's business. If business has been large it has been unprofitable, simply on account of the low prices, and there are many and many a transaction which operators must deeply regret ever having entered into, the result of which has been to leave an enormous loss. In the first place, the low prices have so minimised the profits of suppliers that they have endeavoured to make up the deficiency by increasing their output, the wisdom or folly of such a policy having led to much criticism, but whatever may have been the pecuniary result to the suppliers themselves it is certain that this course has had a very detrimental and depressing influence upon our markets here. Again, the low prices have proved very unremunerative to the manufacturers throughout the country. True by being able to purchase their raw material at cheaper rates they have been enabled to make further concessions in prices, but buyers for the most part would not place their orders with only a proportionate reduction in prices. They have cut manufacturers down to the lowest ebb, they have pressed them to accept lower and lower rates, and manufacturers in order to do business have been forced to use every economy in the cost of manufacture. They have been obliged to reduce the wages of their men, which has necessarily tended to maintain a continuous run of strikes, first, in one part of the country, then in another, and which has been the means of causing a vast amount of distress in almost all the manufacturing centres. Deliveries from this cause have at times been delayed, but as few strikes have continued for any length of time, and as generally there has been only a limited number of orders on the books at the various works at any one time no particular inconvenience has been occasioned by the foregoing cause. Further the low prices have proved exceptionally unfavourable to agents and middle men. Commissions in consequence have been greatly cut down, and perhaps this class of traders have suffered more than any others during the year, because on account of the keen and close manner in which business has been transacted there has been a tendency to pass by the middlemen altogether, and consumers and shippers have gone direct to manufacturers so as to secure the ordinary agents or brokers commission.

Thus the middlemen have suffered not only from reduced profits on the business actually done by the low prices, but also from a more limited business done by them. Shippers, too, have gained nothing by the cheap rates, their limits from indentors abroad have been so low that often the export merchants here have only been able to do the business with the bare margin of profit, and not infrequently have the orders had to be returned for increased limits. Perhaps, this has not been so often the case as in a few previous years, owing, no doubt, to the depression in the markets here constantly causing prices to recede, and thus often securing orders before they have expired, although sent over under market prices at the time. Consumers alone, both at home and abroad, have been those who have benefited by the low prices, and they have freely availed themselves of the low rates, deliveries at times having been exceedingly heavy. The wants of the trade have been constantly growing, and business has developed in almost all branches. There has been a vast expansion in the demand, and the low prices have enabled others save the most wealthy to deal in metals. This, of course, in itself has been a very satisfactory point, and providing metals could be turned out at a fair margin of profit to the supplier, then it would be desirable to regulate prices at such low figures as to enable the whole community to purchase them, not only for existing requirements; but also to stimulate enterprise in all parts of the country, and to induce our colonies to continue purchasing from the mother country. If, however, the low prices have stimulated the demand and expanded the wants of the trade as might have been expected, they have also produced an increase in the supplies which could not have been looked for. This has arisen from the cause to which we have already referred, the endeavour to make up for the deficiency in profits upon an ordinary output by making increased sales. However, this has not been general throughout the whole trade. It has been merely a characteristic of some metals, and in others, notably quicksilver, the low prices have been the means not only of checking supplies, but also of the enforced closing of some of the mines. The low prices throughout the year have been the special feature of the markets; but there have been likewise other influences at work, both in favour of and detrimental to the markets. The principal features which ought to have supported prices have been the bountiful harvests realised in this as well as in other countries. From this cause much increase in the demand was anticipated, but general trade had been brought to such a dull, gloomy, and depressed condition that the usual stimulus did not arise from this cause, and metals have largely shared in the general inactivity. Another feature prominently in favour of the markets has been the cheapness of money during the greater part of the year. There have been the greatest facilities of finance nearly all through the year. Money has never been dear, and for the most part it has ruled at a very cheap rate; but even this has failed to remove depression.

It may have assisted in developing the demand, it may have tended to augment business, and partly to this cause may be attributed the good deliveries, because with cheap prices and cheap money, enterprise has naturally been somewhat encouraged and the demand augmented. At the same time, whilst deliveries have thereby been stimulated, assistance has also been afforded to suppliers to increase their output, and stocks are more easily held, which has necessarily produced a somewhat heavy drag to the market. The unfavourable influences of general bad trade, of difficulties in home and foreign politics, of a few heavy failures, and other features, have tended to keep the market for all metals low, and to establish general depression; but it is remarkable that after such a prolonged period of depression of unprofitable prices, when losses have been so numerous, that there should have been so few failures announced. It may be taken as an evidence of the safety and soundness of business, for the total number of failures gazetted during the year have been comparatively very small. We give a separate detail account of each metal, showing the various changes that have occurred, and here we may mention that, speaking generally, the result of the year's business has been unsatisfactory to all except perhaps to those who had sufficient courage to "bear" the markets when prices were exceptionally low, and when there were many features which strongly indicated a probable substantial advance in prices.

COPPER.—The principal characteristic of this metal during the past year has been its excessive cheapness, a feature, however, which has tended to develope the deliveries to an enormous extent, the consumption having increased by about 15,000 tons over and above what it was in the previous year, which in its turn was considerably larger than in 1882. Supplies have also greatly increased; but they have not been adequate to the demand, and the consequence has been a sensible reduction in the total stocks. The supplies have not been much increased from Chili and Australia, but the new sources have poured copper upon the market in abundance, very heavy quantities of Spanish pyrites and American copper having come forward. The uncertainty of American supplies has often been a great drawback to the market; it has checked any better feeling that was beginning to make itself manifest, and often caused considerable depression. Although during the year there have been some unfavourable features in the market, yet at the same time prices have evidently in great measure been kept down by the unfavourable influence of extreme quietude in general trade. To this cause must chiefly be attributed the depreciation in prices. We have now a less stock of about 1000 tons than there was at the commencement of the year, and the price is about 10*l.* lower. As regards prices, they were at their highest at the commencement of the year, and about their lowest at the close. Stocks were lightest in September, and partly to an increase since that month may be attributed the serious fall that has been made in prices. The heaviest stock was on the first day of the year, when, as we have already said, prices were at their best. Owing to the low price, and the occasional fluctuations in the market, the quotations for Australian copper, particularly Wallaroo and Burra Burra, have invariably been nominal, whilst in English manufactured the smelters have for the most part been tolerably busy throughout the whole year; but they have had to submit to very low prices, and orders, especially for shipment, have been received at exceptionally low limits. The market opened for Chili bars in January at 58*l.*, but owing to some heavy selling, not only by holders, but also by those who were disposed to "bear" the market, the price very quickly receded to 55*l.* 12s. 6d., and this in spite of favourable statistics. Holders were weary of their stocks, investments in the metal were very scarce, and although there was the foregoing wide difference in price in the course of that month, yet at the same time the reduction was not effected without some effort being made to stay the retrogressive tendency, and in consequence there were numerous fluctuations, and before January had closed prices had recovered nearly 1*l.* per ton.

In February, notwithstanding a considerable reduction in the stocks and very satisfactory deliveries, yet the market was much depressed and large sales were effected at further reduced rates. There was a little spurt in prices at the beginning of the month, but this soon collapsed, and the tone became monotonously dull, and later on very heavy charters being announced from Chili, and smelters reducing their price for strong sheets, the feeling became dull and gloomy, and the prospect anything but encouraging. In March there was a further declension of prices, although a good business was transacted. The feeling, however, was very depressed, from fears of augmented supplies both from Spain and America, and the low price and large deliveries failed to attract the attention of investors, and speculators would only operate unfavourably to the market. Although the general tone of the market at that time was unsatisfactory, yet in manufactured there was a good deal doing, and most of the smelters were very busy. During April there was a decided change for the better; stocks were materially reduced, the deliveries very heavy, and not only was the downward course so long noticeable in prices checked, but a sensible improvement was temporarily effected. They recovered to the extent of 4*l.* per ton, when a reaction again set in, leaving the market with a total improvement for the year of 50s. per ton. This little advance enabled some holders to cut their losses, and in a few instances to make slight profits, which was very satisfactory after the prolonged period they had had to submit to, when losses had been frequent and profits scarce, and many of the weak holders sold freely in face of unfavourable advices from India, the advancing rate of discount by the Bank of Bengal, and uncertainty of future supplies. During May there was a good demand for manufactured, and most of the smelters were well off for work, but deliveries were not equal to the large quantities of the previous month. In Chili bars, however, there was a good deal of irregularity, and towards the close of the month 55*l.* was accepted, but following this there was a sharp rally of 20s. The low price—not low compared with what has been since touched—but low in comparison with any previous time, made most holders hesitate before parting with their stocks, and various efforts were put forward by them to stay the retrogressive tendency, and hence the little spurts which were every now and again made in this metal. In June the market was in a very dull and uninteresting condition; prices continually tended in favour of buyers, and stocks were increased. The deliveries, however, were fair; but in the middle of the month the Chili charters were heavy, and there was a general gloomy view; existing operators could not be tempted into making purchases, so that the market dragged, and prices touched about as low a figure as was ever before known.

This in the last days of that month gave a little impetus to the demand, and a decided turn for the better took place in prices. This little rise was carried on into the first few days of July, but not being followed up the market soon again relapsed into quietude, which resulted in a still lower range of price, 53*l.* 10s. having been accepted for g.o.b.s. The market was kept down chiefly on account of the uncertainty of American supplies, and no reliable information could be obtained as to what might or might not be forthcoming from that country. Nevertheless the deliveries proving exceptionally heavy, a sharp advance was effected in the closing days of the month, and the price recovered to 55*l.* cash. Although manufacturers were busy with old orders fresh business was scarce, and very little was doing with India, whilst prices for all descriptions of manufactured were entirely nominal. During the first week of August there was an animated demand for Chili bars, between 54*l.* 17s. 6d. to 55*l.* cash and 7s. 6d. to 10s. higher for forward, and a heavy fall in one day brought the price down to 54*l.* 5s.; but the deliveries for the first half of the month being again reported heavy the tone revived, although no particular improvement could be obtained in prices, and as the deliveries during the latter half of the month fell away, the price also receded and the tone became dull and gloomy. The market in September was most disappointing, notwithstanding the deliveries were the heaviest on record, the adverse movement in prices being principally due to the adverse state of other metals and heavy supplies; but notwithstanding the heavy supplies they were about 2000 tons under the unprecedently large deliveries. Heavy charters from Chili were also advised for the first half of that month, but this did not make much impression upon the market, as holders possessed confidence in the stability of prices through the good deliveries then announced. Operators, however, not caring to make purchases, the price fell away to 53*l.* 15s., but picked up again towards the end of the month to 54*l.* 2s. 6d. This little spurt, however, was of but short duration, and early in October the price again began to dwindle in favour of buyers.

In fact, during the whole of that month the market was in far but a satisfactory condition. The deliveries were not nearly so good as in the previous month; the supplies were almost as heavy, the consequence being an increase in stocks, whilst the Chili charters were extremely heavy, amounting for the whole month to 5200 tons. In consequence of these adverse features, and the unfavourable influence of bad trade generally, the price of Chili bars receded to 52*l.* 12s. 6d. cash, and only 53*l.* forward, at which the market closed with no anxious buyers thereat. At the beginning of November there was another slight attempt made to push up prices, but the effort proved altogether useless, it merely delayed the fall, and business in Chili bars was done at irregular prices down to 50*l.* 2s. 6d., from which point, however, there was a rally at the end of the month to 51*l.* 10s. It will have been noticed as a peculiar characteristic of the market, that in many months of the year the tendency of prices at the beginning and end of the month has been upward, and in the interim irregularity and downward prices, the result always proving against holders. Besides these fluctuations in prices, there was no special feature in the market during November. As regards prices, the last month of the year has undoubtedly proved the worst, not only in the year just past, but also of any previous time. Holders who generally had succeeded in sustaining the market tolerably well lost all control over it, and sales were effected at an enormous sacrifice. Day after day the price descended lower and lower; the gloomiest views were held of the future, fears of increased supplies were again constantly being expressed, and the price having broken through the fifties, no limit was spoken of as a likely minimum that prices might touch. Copper sheets for India were sold as low as 58*l.*, and yellow metal sheets touched 4¼d., while sales of Chili bars were effected on Dec. 31 at 47*l.* 2s. 6d., being the lowest point ever touched. About the middle of the month a change for the better commenced, owing more especially to good deliveries, and although for about a week there was little alteration, yet the market was decidedly stronger, the hardening tendency ultimately developing into greater activity, and prices steadily advanced some 20s. or 30s. per ton. The low price stimulated the demand for consumption, but shipping orders continued limited, and the little advance not being followed up, the market once more assumed an easier tendency, and closes for the year with a quiet and dull tone.

IRON.—The past year has been a very uneventful one as regards iron, the fluctuations in manufactured being very slight. Prices, however, have tended gradually in favour of buyers, and at the close of the year prices for common bars are about 10s. per ton cheaper than they were at the commencement, and iron rails have fallen to much about the same extent; while nail-rods and hoops, sheets, and plates have fallen about 20s. Scotch pigs have also depreciated in value rather more than 1s. per ton, and Swedish iron is steady, at about the same figures as were being realised at the beginning of the year. In manufactured the market has often suffered from the supplies being in excess of the demand, sellers have been very plentiful, and buyers have invariably limited their purchases to their most pressing requirements. The competition has always been extremely keen, but there have not been so many complaints this year as we have known in the few previous years of the keenest of competition with foreign countries. This may arise partly from the fact that the trade is beginning to get accustomed to the foreign competition, and, in consequence, do not attach so much importance and attention to it as they did when it was first felt, or, more probably still, it may arise from prices here throughout the whole of the past year having been exceptionally cheap, our manufacturers have been better able to compete with Belgium and other countries. The competition has been principally among the manufacturers here themselves, Staffordshire having specially suffered from the competition of sellers in the North. It has been found that consumers, and, more particularly, shippers, have again not considered the question of quality so much as price; and, consequently, while most of the very cheap sellers, or, rather, we should say, the cheapest sellers, have been very busy nearly throughout the whole year, sellers of higher class, and, in consequence, dearer iron, have found great difficulty in keeping their works in operation. The year opened badly for the trade, and, although there have been a few temporary symptoms of improvement, every now and again making themselves visible, yet, at the same time, the trade during the whole year has been unsatisfactory, and, if anything, closes worse than what it has been at any other time. In course of the year public attention has been attracted to the deplorable state of the shipbuilding trade. At no time can it be said to have been very brisk, although it was at its best in the early months of the year; but, orders being speedily worked off, and no fresh ones coming forward to take their place, many of the men had to be discharged, and great distress was, in consequence, occasioned amongst the working classes; but during the latter months of the year there has been a little more doing, and, although the trade is still dull, yet encouragement and more sanguineness is found in the determination of the Government to increase the navy.

There have also been constant difficulties between employers and employed with regard to wages. No serious strikes, however, have taken place like that in the summer of 1883, and as strike difficulties are now becoming, as it were, an every day occurrence but little notice is taken of them. The strikes during the past year have never lasted for any length of time, a few days or weeks at the most, when the men have invariably returned to work upon the masters' terms. They have seen the advisability of returning to work, they have experienced the distress when many masters have been obliged to close their doors, to damp down their furnaces, and to work generally only short time, so that they have for the most part considered it inadvisable to remain out long on strike, particularly as there were many unemployed who would doubtless have been ready to take their places had they continued out on strike for any length of time. Shipping business has invariably been dormant, the low prices having failed to stimulate business to such an extent as might have been anticipated. Profits in the trade have been reduced to a minimum, some sellers have refused to sell at all at the unprofitable prices, preferring to do nothing than work at a loss, whilst others have endeavoured to make up the deficiency in profits by increasing their output. In Scotch pigs the fluctuations have mostly been trivial, and speculative buying has been exceedingly quiet. The market has suffered, more or less, from purchases of Middlesborough iron in place of Scotch, owing to its cheaper value, at the same time the exports of iron from Middlesborough to Scotland have not been very much more than they were in 1883. The most adverse feature in the Scotch market has been the enormous falling off in the shipments; they were more than 113,000 tons less than in 1883, and also considerably below those for any time during the last six years. The public stock has been reduced by about 7000 tons, but this has made no favourable impression upon the market in face of the numerous other unfavourable features. During the early part of January Scotch pigs were extremely flat, and as low as 42s. 6½d. was accepted, while the stock in course of that month increased by 5419 tons. The Middlesborough ironmasters, however, having declared their determination to damp down 18 furnaces a slight impetus was given to the demand, and the price rallied to 44s. 7½d., the highest point touched during the year, but it quickly receded again to 43s. 4d., buyers.

The stock in February continued to increase by another 2759 tons, and the demand being exceptionally quiet, the price gradually fell away to 42s. In March the fluctuations were very trivial; nevertheless they tended in favour of buyers, and the closing figure for that month was 42s. 4½d. Nevertheless business was extremely dull, and the public stock was further augmented by 1393 tons, and amounted at the end of the month to 594,608 tons, the largest recorded stock for the year, for in April there was a diminution of 1884 tons, and during that month there was great steadiness in the tone, the widest fluctuations between the highest and lowest points touched being no more than 4½d. In May there was a further diminution in stock of 1856 tons, and also a declension in prices to 41s., the market being quiet and featureless throughout, and in the first few days of June 40s. 10d. was accepted, when there was a sharp advance to 41s. 9d., but followed by a reaction to 41s. 2d., the stock again decreasing by about the same quantity as in the few previous months—1866 tons. In July prices were very steady, but at the close of that month there was a hardening tendency, whilst the stock was reduced by another 1446 tons. The variations in August were slight, but some of the special brands of makers' iron being scarce prices for such brands were slightly higher, and a further decrease of 1664 tons was effected in the stock. In September the stock was heavily reduced by 2295 tons, and a considerable business was done in that month at improved prices, but the market did not close at its best, whilst a still greater reduction was effected in the stocks in October of 3165 tons, and a large business was transacted at advancing prices, the closing figure for the month being 42s. 9d. This advance was due not only to a fair ordinary trade, but more particularly to the covering of heavy "bear" sales, whilst in November from the same cause the market was excited, and the price advanced from 42s. 4½d. to 44s. 4½d., and then back again to 42s. 10½d., the public stock in that month being only reduced by 789 tons. In December the stocks in Glasgow were again slightly reduced, but only by very small quantities, nevertheless at the commencement of that month some of the furnaces in Scotland were damped down, which had the tendency to preserve the steadiness of the market. However, the tone was rather flat, and during the first fortnight the price gradually fell away to 41s. 10d., from which point there was a steady advance, although no particularly fresh feature occurred. By a steady progressive rise the price recovered nearly 1s., and in the last fortnight of the year a slight increase was made in the public stocks.

TIN.—Owing to the bad state of general trade throughout the whole of the past year, speculation in this metal has not been so extensive as what is generally the case, and the fluctuations have not been nearly so wide as in some previous years; nevertheless there has often been some sharp movements, both in an up and downward direction, the latter, however, preponderating, so that we close the year with prices about 11*l.* lower than they were at the commencement. A very large regular business has been transacted, and with but three exceptions—July, September, and December—the deliveries have each month exceeded 2000 tons. This is a very satisfactory sign, and it becomes difficult to understand the cause of the declension in value, particularly as supplies have been well regulated and closely kept within the requirements of the trade, so that the stock is now about 2000 tons less than what it was a year ago. From time to time there has been a good deal of disposition shown to "bear" the market, and such operators have been well rewarded for the risks they have run. The "bear" influence was particularly noticeable in early January, when the downward tendency of prices was accelerated solely from this cause, 81*l.* 10s. being touched for foreign, or a reduction of 4*l.* 10s. upon the opening price for the year. Some efforts were then put forward to restore the market, which were partially successful, and up to 84*l.* 2s. 6d. was touched; the market, however, again soon receding to 82*l.* 10s. The Banca sale, held on Jan. 31, in Holland, realised an average figure equal to 85*l.* 17s. 6d. The stocks here during that month were somewhat increased owing to heavy arrivals, but the total stocks, including those in America, were diminished by about 770 tons. In February, notwithstanding a repetition of heavy deliveries, the stocks in London again increased, but the totals, including America, were about 1100 tons less. At the beginning of that month some improvement was visible, and a better feeling existed, and prices recovered to 83*l.* 12s. 6d., but the dormant state of the speculative enquiry, and the uncertainty of political affairs produced an easier tendency, 82*l.* 5s. again being touched at the close of the month, whilst there was less disposition to purchase forward, and the usual difference between cash and forward prompts was not obtained. Advices from America reported the market there flat, and much lower rates were being quoted than those here, whilst some of the other foreign markets were said to be in a lifeless condition. During March the market was very irregular, but notwithstanding all the changes there was only a gain of 10s. in the price in the course of the month.

At the beginning of March a rumour was started that many of the mines in the Straits were flooded, which caused recent "bear" operators to cover their sales, and which created a rise within a few days to 85*l.* 2s. 6d., but these rumours not being confirmed the price soon fell away again to much about the same figure as it started from, but picked up slightly upon reports of a diminished Australian supply, and ultimately closed at 82*l.* 15s. Here we may mention that Australian has fetched a rather better price than Straits at almost all times during the year. At the Banca sale at the end of March 87*l.* 5s. was the average price realised, and during the whole of that month the Dutch market, like our own, showed a good deal of animation. In April stocks were further slightly reduced, and a recovery was then effected in prices. There were large dealings in the metal, and the price continued to harden up to 86*l.* 2s. 6d., thus regaining all it had lost in the early part of the year; but this advance was not to be long upheld, and the price receded to 85*l.* 10s. There was a great scarcity of Australian during that month, and it realised as much as 10s. premium. The Billiton sale, held in Batavia at the end of April, fetched an average figure equal to 88*l.* In early May the market was excited upon reports of probable reduced supplies, diminished stocks, and a bright future, the price for cash advancing to 86*l.* 15s. forward, 10s. to 15s. per ton more being the highest figures touched during the year. The rapid advance was rudely checked by the financial panic in America, which then took place, combined also by some heavy unlooked-for supplies from the Straits, and the deliveries not being quite so good as usual, a heavy increase was made in the stocks, whilst at the public sales of Banca and Billiton the average figures realised were 88*l.* 15s. and 85*l.* 10s. respectively. During June the stock was reduced by more than 1100 tons, but the price receded 20s. a ton. It was a month in which many fluctuations occurred—both ups and downs—ultimately closing, as we have already stated. The two great parties were actively engaged upon the market, and it was at the time quite impossible to foresee which would obtain the upper hand, because there were numerous influences to support both sides. The supplies were light and the deliveries satisfactory. The market closed strong, and with a similar characteristic it opened in July, when the price was advanced to 83*l.* 12s. 6d., but rumours of heavy shipments from the Straits placed a damper upon the tone, and the price receded to 81*l.* 7s. 6d., but from which there was a steady recovery to 83*l.* The rumours of increased supply proved to be without foundation, but diminished deliveries the smallest in any month during the year caused a slight increase in the total stocks; but only when America's stocks were taken into account. The average price realised at the Banca sale in that month was equal to 85*l.* 10s.

At the early part of August the market was steady, or at least as steady as could possibly be expected in this fluctuating market, but towards the latter part of the month there was a good deal of irregularity in the quotations, and holders were quite unable to sustain the market prices falling away at the close to 81*l.* 10s., notwithstanding an exceptionally heavy delivery during the month, while stocks were reduced by about 550 tons. In early September owing to many "bears' covering in their prompts there was a sharp rally to 83*l.*, upon which a disposition was evinced to press sales, and forward prompts were offering under cash, and during the last fortnight of the month the price fell away to 78*l.* 12s. 6d., with eager sellers over at the close. The statistical position of the market became more unfavourable, and the tone was much depressed. The Dutch market was also flat, and the average price realised at the Banca sale was 82*l.* 10s. The downward tendency of prices was continued during the first part of October until 72*l.* 10s. was touched, the lowest figure quoted during the year. A determined effort was then made to stop this downward course, and within a few days an advance was effected up to 77*l.* 7s. 6d., large quantities changing hands. This spurt, however, was short-lived, and the price receded again to 73*l.* 15s. There was an increase in the stock, but not sufficient to warrant the heavy fall in prices, and the deliveries during October were, if not unprecendently heavy, yet larger than in any other month during the year. The variations in November were only trifling, but, on the whole, there was a hardening tendency, and in course of the month the price stiffened up to 75*l.* 10s., but receded again nearly 20s. the only feature of interest during that month being the Banca sale, which realised an average price of 77*l.* 10s. per ton.

In early December the price continued to tend downwards, not from any unfavourable feature in this market, but simply owing to the general depression in trade, and the shyness of operators to purchase at any figures at all, and 72*l.* 17s. 6d. was touched. But as the position of the market was very satisfactory, that is to say, stocks were light, deliveries large, and supplies within the requirements of the trade, there was a decidedly improved turn, and after keeping steady with a hardening tendency for a short while there was a smart and sensible advance. At the early part of that month prices may have been kept down in some measure by rumours of fresh discoveries of tin in America, and fears were held lest heavy quantities, as in copper, might be poured upon our market, but these rumours being apparently without foundation, operators had more confidence in the permanency of the advance made at the end of the month, the market closing with a fair amount of steadiness.

LEAD.—During the whole of the past year this market has been very quiet, and only trifling fluctuations have occurred in prices, although quotations have lost ground in the course of the year. The market opened with buyers of Spanish at 11*l.* 12s. 6d., and of English pigs at 11*l.* 17s. 6d., but soon afterwards Spanish strengthened to the extent of 2s. 6d. and English 7s. 6d. per ton, which improvement was well followed up, and by the middle of January 11*l.* 17s. 6d. was being realised for Spanish. At this point, however, buyers became shy, and the market assumed a quiet aspect, and the price fell to 11*l.* 15s. 9d., while during February quotations continued to crumble away with but little check, 11*l.* 8s. 9d. being accepted at the close of that month for Spanish and 11*l.* 15s. for English. Throughout the whole of March the market was very dull, and prices further fell to the extent of about 1s. 3d. per ton per week until 11*l.* was accepted for Spanish and 11*l.* 7s. 6d. for English, but in early April the market became steadier, the downward tendency was arrested, and the market then became firm, but transactions were not numerous. Later on in the month sellers were asking an advance of 2s. 6d., and buyers were ready to pay 1s. 3d. rise upon previous prices. This little spurt, however, was of short duration, and the market soon became dull, and in early May was once more being quoted at the same figures as before the rise, and throughout the whole of that month, although at times sellers were asking 11*l.* 2s. 6d., yet very few buyers would pay more than 11*l.*, and at the commencement of June vendors finding it impossible to hold out again took lower rates, and the price fell away during that month 12s. 6d. to 15s. per ton. During the first half of July the demand was exceedingly dull, and still lower rates had to be accepted in order to effect business; but towards the close of that month there was a smart rebound of fully 5s. per ton. This spurt was followed up to about the middle of August, when 11*l.* was again being quoted for Spanish; but English pigs could also be bought at that figure. After which the market became easier, and in course of August Spanish fell fully 10s. per ton, but English maintained its own. Throughout the whole of September the market was quiet, and there was very little change in quotations, the principal characteristic of the market being that sales for forward delivery were effected under those for prompt. In early October the market became stronger, 10*l.* 17s. 6d. even being asked for Spanish; but the market soon receded, and became flat at the close of the month at 10*l.* 16s. 3d. per ton. During the first week of November it was much depressed, and 10*l.* 10s. was accepted for Spanish and 10*l.* 17s. 6d. for English; but later on in the month the market became decidedly firmer for Spanish, the price advancing 5s. per ton, but afterwards receded 2s. 6d. for forward prompts and 1s. 3d. for cash, this difference arising from a check to supplies by the cholera precautions taken in Spain. No further change was effected until the middle of December, when the market was again stronger at 10*l.* 17s. 6d., and even 11*l.* for Spanish, while English was also dearer by 2s. 6d. per ton. This little better tone continued until the close of the year, the market closing firm.

SPELTER.—Throughout the whole of the past year the demand for English hard spelter has been sluggish, and prices nominal, the various sellers having their own quotation, and no price being general. About the average figure has been 10*l.* 10s. per ton, but sales have at no time been heavy, many of the works having disposed of their spelter by private contract, and not offered it upon the market. This has been particularly the case with choice and selected brands, and it has often necessitated the return of many orders which have been received for stipulated makes. As regards Silesian the market opened quietly at the commencement of the year at 15*l.* 5s. for ordinaries, and 2s. 6d. more for specials; and during January, owing to a very limited demand, prices crumbled away, ordinaries at the close of the month realising only 14*l.* 15s., but specials being scarce a full 5s. above this price was obtained. Throughout February there was considerable stagnation in the demand, and prices continued to tend in buyers' favour, sellers at the close of the month being unable to secure above 14*l.* 7s. 6d. for ordinaries. This low figure created a temporary briskness in the demand, but before the first half of March had closed this little extra disposition to do business had subsided, and buyers appearing well covered sellers were not indisposed to accept lower rates. However, cheaper prices had the effect of slightly stimulating the demand, and sellers then raised their price to 14*l.* 10s., which immediately checked business, and in early April the market regained this little rise, then continuing quiet during the whole of that month, and without further variation until about the middle of July, when prices lost about 2s. 6d., and were quoted down to 14*l.* 5s. Throughout the whole of that long period of steadiness in prices, even the slightest fluctuations being entirely absent, the demand was exceptionally dull, and at times made more so by the slackness in the galvanising trades.

At the end of July there was but little demand, and the price of ordinaries further receded to 14*l.* 2s. 6d. In the first week of August business was so difficult to secure that some sellers of ordinaries accepted 14*l.*, and later on in the month this figure became the general quotation. At one time it seemed to slightly encourage business, but the demand again relapsed into quietude. No further change took place until the first week in September had passed by, when the market suddenly became very firm, large transactions were carried through, and up to 14*l.* 5s. was realised. This advance was followed in the next week by another rise of 5s., an extensive business being transacted, and later on in the month 14*l.* 10s. to 14*l.* 12s. 6d. was the general quotation. The low prices largely stimulated the demand, and it was thought that from the same cause many of the smaller mines would have to stop their production. Throughout the whole of October no fresh feature occurred, and the price of ordinaries remained firm and steady at 14*l.* 10s., and of specials at 14*l.* 15s. per ton. At the beginning of November the market became rather easier, and the demand was quiet at 14*l.* 5s. to 14*l.* 7s. 6d. for ordinaries. At this figure the quotation kept steady until the close of the month, when 2s. 6d. less than previous prices was accepted for both ordinaries and specials. The demand continued inanimate, and about the middle of December 14*l.* was taken for ordinaries, at which the market afterwards continued quiet and steady, closing thereat for the year, although some sellers were asking 2s. 6d. more, and the closing quotation for special brands was 14*l.* 7s. 6d. to 14*l.* 10s. per ton.

STEEL.—The changes in this market have not been very important, and business has at times been brisk, but at others very quiet. The quotations for rails have invariably been nominal, and other descriptions have scarcely altered in value at all. Steel has now taken the place of iron to such an enormous extent that there is always a fair business doing in this metal; but it is open to question whether the prices realised have left any margin of profit to the seller, and many are the complaints of the prices that have been obtained, particularly for steel hoops for shipment. The difference between steel and iron hoops has been only about 30s. per ton, although sellers have shown more reluctance to accept cheaper rates for their steel than what they do for the iron. Although competition in steel is keen, as well as it is in iron, yet, at the same time, recent iron manufacturers are taking to turn out steel, so that they may not lose the entire trade. The converting of the works hitherto used for the manufacture of iron so as to enable them to turn out steel does not appear to be a very costly or difficult undertaking, and some of the ironmasters have, in course of the year, turned their attention to steel—an example which all have not yet followed, but which will doubtless, sooner or later, be undertaken by the whole iron trade. Steel rails at the commencement of the year were offering at 4*l.* 5s. at works, and there was but a sluggish demand; and later on, in January, 2s. 6d. less was accepted, while wages disputes in the North tended to unsettle the trade. Up to the end of February the market remained very dormant, stagnancy being reported in almost all branches, and prices tending in favour of buyers, but without quotable change. A little more business was then transacted, and early in March, owing to the very unprofitable price of rails, makers united together to raise the quotation to 5*l.* per ton. This continued for some time the nominal quotation, but sales in the North were effected as low as 4*l.* 10s. and 4*l.* 12s. 6d. In April there was little change, prices tended in favour of buyers, but without any alteration in quotations; and towards the latter part of that month some fair shipments were made to India. For a long time after this the demand kept quiet, and in the middle of June sellers reduced their official quotation of rails by 7s. 6d. per ton; but this did not stimulate the demand, as sales for many months previous had in reality been effected thereat. In early July there was a slightly better demand at Birmingham for steel sheets, but the market soon again relapsed into quietude, when it kept featureless until September, a slightly better demand for rails then springing up. Afterwards there was a decidedly better demand, which continued until the last month of the year, when the demand again became quiet, and in early November prices for rails were advanced 5s., at which the market closes steady.

TIN-PLATES.—Throughout the whole of the past year prices for tin-plates have been remarkably steady both for cokes and charcoals, although, like most other metals, they are now cheaper than what they were at the commencement of the year, Nevertheless a fair business, on the whole, has been transacted, and most of the works have been tolerably well employed, but others have at times suffered from a want of business. At the beginning of the year sales were small and the demand dull, and sellers became a little easier in their quotations as the month of January progressed. This rather encouraged the demand for charcoals, but there was a paucity of business in February; prices were again lower, although coke wasters were comparatively high, consumers and shippers continuing to be indisposed to avail themselves of the easy rates, the market dragged on in a featureless condition. At the beginning of March, although 15s. was the general quotation for coke wasters, yet sales were made at 14s. 9d. Business kept quiet until just the end of March, when rather more was doing at unaltered prices, and in early April a decidedly brisker business was carried through. The improvement in business was manifest during the whole of April, and some works at the end of that month advanced their price 1s., but others made no change. In early May a few second-hand parcels were offering at cheap rates, but makers kept firm. Some heavy shipments were effected, and there were indications of a rapidly expanding demand for consumption. Afterwards the demand was scarcely so good, and the market remained quiet and featureless; but at the commencement of June there were some fair sales for forward delivery, and at the end of that month, the demand being languid, prices became a shade easier. A fair business was done during the first few days of July at steady prices, and at the Birmingham Quarterly Meeting, held in that month, makers were more hopeful on account of stocks in Liverpool and the American ports being reported considerably reduced. No particular quotation, however, was fixed for prices, and later on prices tended slightly in favour of buyers. The next change worth recording in the market was in early August, when the tone was rather stronger, and a fair business was done in cokes at 15s. 3d., and in wasters at 1s. less, whilst the stocks in Liverpool were reduced to 97,000 boxes. The market continued quiet throughout the month, and a large business was at times carried through. During the whole of September and October a moderate business was transacted, and prices kept steady at 15s. for cokes and 18s. for charcoals, and there was no particular feature worthy of comment during the whole of that time. In November there was no special new feature, the demand being quiet, and prices easier for cokes, both primes and wasters, but charcoals remain steady, and in December there was not much doing, and quotations again drooped in favour of buyers, 14s., having been accepted for cheap qualities of cokes, and quotations for charcoals were also lower.

QUICKSILVER.—For the greater part of the past year this market has been characterised by considerable steadiness, for not until the month of November was there any important change effected in prices. At the opening of the year hardly any business was doing, and the price quoted was 5*l.* 5s. per bottle; but, as January advanced, more business was transacted, and owing to only a few second-hand sales the price became firmer. This better tone, however, was not long sustained; and, although importers made no alteration in their price during the whole of that month, yet the demand was chiefly met by second-hand holders. The Board of Trade Returns for January were not very satisfactory, and in early February, the demand being only moderate, importers reduced their price to 5*l.* 2s. 6d. This low price stimulated the demand to some extent and importers raised their price to 5*l.* 3s. 9d., afterwards to 5*l.* 5s., when they again accepted 5*l.* 2s. 6d., but on the last day of the month were asking 5*l.* 10s., the demand throughout being very fair. The Board of Trade Returns for February were good, and in early March the price was advanced to 5*l.* 12s. 6d., owing to reports that the Californian production had diminished considerably. Importers made no further alteration in their price that month, but the wants of the trade were chiefly supplied by second-hand parcels at about 2s. 6d. less, whilst for the greater part of April, the demand being stagnant, importers reduced their price to 5*l.* 10s., second-hand lots offering at 1s. less, and towards the close of the month they accepted 5*l.* 8s. 3d., but quickly again advanced it to 5*l.* 9s., the demand suddenly improving. Afterwards 5*l.* 10s. became the general quotation, but the Board of Trade Returns showing the smallest exports for many months had a depressing influence upon the market; nevertheless, importers kept steady in their price for the greater part of the month, but at the close accepted 5*l.* 7s. 6d., and sales from second-hands were carried through at still cheaper rates. The deficiency in the exports during April were made up in the following month, but as the month of June progressed importers reduced their price to 5*l.* 5s., but apparently dissatisfied with the sales effected thereat, further reduced the figure to 5*l.* 3s. 9d., this causing a good increase in the demand and the quotation was soon restored to 5*l.* 5s. again.

In early July there were very few secondhand lots offering, and the demand was very large at importers' price, which induced them to ask an advance of 2s. 6d., after which the market was quiet and featureless, sellers towards the end of the month accepting 5*l.* 5s.; but soon advanced the figure to 5*l.* 6s. 3d, at which the market closed steadily for July, and for the greater part of August the market was featureless at this figure; but at the end of that month it stiffened up to 5*l.* 7s. 6d., and later on to 5*l.* 10s., owing to advices from San Francisco indicating that the output in California had further materially diminished, owing to the serious losses incurred in working at the then current prices. The production for the first six months of the year was smaller than for any corresponding period of any year since 1874, when prices were at their highest. During the whole of September the market was very steady and firm, gradually stiffening to 5*l.* 12s., and a good demand existed, and in October the importers made no alteration in their price; but secondhand lots were offering at cheaper rates, and the reports of the production in California again showed a considerable diminution, whilst towards the close of that month secondhand lots were less freely offered. The disappointing Board of Trade Returns for October tended to keep the market quiet early in the following month; but as soon as the first week of November had passed there was a sharp turn for the better in prices, owing to a very large demand for both export and speculation, and all secondhand lots on offer being eagerly bought up importers advanced their price to 5*l.* 15s., which rather tended to stimulate the enquiry than otherwise, and the demand continuing active importers rapidly advanced their rate before the close of that month to 6*l.* 15s., while the price at San Francisco was equal to 7*l.* 10s., with a short supply and few sellers. For the greater part of December importers' price remained steady, and as that month wore on secondhand lots were offered less freely, while towards Christmas importers would not sell in large quantities under 6*l.* 17s. 6d., the market closing firm for the year at 6*l.* 15s. to 6*l.* 17s. 6d. per bottle.

ST. AUSTELL DISTRICT.—In spite of the depression which has existed during the past year in tin mining in Cornwall, it is gratifying to be able to note that in the St. Austell district there are signs of reviving trade. Two gentlemen have secured in this district several very valuable properties, and have devoted a large amount of capital to the development of one of them. The Woodclose Mine, closely adjoining Old Sticker, has during the past two years been thoroughly prospected by the most able mining engineers, with results which induced the proprietors to erect large and valuable machinery, the completion of which with all the latest improvements are to-day being inaugurated by a dinner to those employed on the mine, and in the evening a banquet will be given at St. Austell to the mining engineers, agents, and others interested in tin mining in the district, full particulars of which will be given in next week's *Mining Journal*.

GOLD COINAGE IN NEW SOUTH WALES.—During the period of 1855 to 1883 the gold received for coinage at the Sydney Mint amounted to 13,633,504 ozs., valued at 51,943,991*l.*; of which 6,703,357 ozs., realised at 25,657,357*l.*, came from New South Wales, and the remainder from Queensland, New Zealand, Victoria, Tasmania, and elsewhere.

Original Correspondence.

GUINEA COAST GOLD MINING COMPANY.

SIR,—In my letter of Dec. 16 I showed that certainly as soon as March, 1883, the directors had determined to abandon the Izrah property, but I think there can be no doubt that they discovered that they had been taken in almost directly after they paid the vendor. It will be remembered that the prospectus described a reef that could easily give 50 tons of quartz rich in gold daily, and that the directors were so confident of this, that to avoid "sickening delays" they had then already taken steps for mining crushing machines. This statement and the fact that 75,000*l.* was paid for the reef shows that when the prospectus was drawn up the directors were certain of the existence of this rich reef (though on wholly insufficient grounds, as we now know); but, notwithstanding this, directly the company was floated the directors at once abandoned the idea of getting stamping machinery, and Mr. Johns, with effrontery rarely equalled, at the annual meeting in 1883, actually took credit for not having sent out any machinery until they had found something to crush. This was said in the face of the statements in the prospectus above referred to, to statements made by himself, for the purpose of inducing the public to take up shares.

The directors are in a dilemma from which they cannot escape. If they really believed that the rich reef had any existence in fact, why was the promise of the prospectus deliberately ignored? If they did not believe in its existence, why was the promise made, and how came they to pay 75,000*l.* merely for the privilege of trying to find a reef that might, if found, be worth nothing? For my part, I am quite satisfied that nearly a year before March, 1883, they had very good reasons for believing that they had paid 75,000*l.* for worse than nothing.—*New Broad-street, Dec.* 30. P.

OSCAR GOLD MINING COMPANY.

SIR,—I have read with interest the letters referring to the Oscar Company's Mine in the last two *Mining Journals*, and will make a remark or two about them. "A. S. O. S.," in the Journal of Dec. 20, compares the capital of the Oscar Company with that of some of the large Transvaal companies, and draws conclusions highly favourable to the Oscar Company because the capital of these companies is so much larger. He appears not to see that if the Transvaal companies have larger capitals their possessions are proportionately much larger still, for whilst the Oscar Company measure their land by yards, these big companies measure by miles.

In proportion, the Oscar Company have given enormously more for their bit of land than the dearest of the Transvaal properties. I believe strongly in Oscar, but if comparisons are to be made do not increase their proverbial odiousness by making them unfair. "F. H." in last week's *Mining Journal*, hints at the possibility of selling or letting portions of the Oscar property. With regard to the remarks I am going to make respecting the selling and letting of portions of a mining property, I wish it to be understood that these remarks are intended to be quite general, and not to apply to this or any other company in particular.

I hold that directors should never possess the power of alienating any portion of a mining property, either temporarily or permanently, without consulting the other owners—the shareholders. The possibilities of collusion between the negociating parties in semi-secret transactions of this kind are so almost absolutely without any really efficient safeguarding circumstance, that one cannot help hearing that there are a few to whom this fact would form a basis of temptation which, unfortunately for the interests of the shareholders, might prove irresistible. Boards of directors are also occasionally greatly misled in matters of this kind by their manager, and it is sometimes impossible to understand how advice so obviously unfavourable to the interests of the shareholders could be given to the directors by one so well situated for knowing.

To return to Oscar. If it would have any subsidiary company to work other portions of the estate, it stands to reason that it would pay the Oscar Company a deal better to work it themselves. The El Callao Company did not become what it is by this wretched system of subletting and subselling, but by holding on, and, in spite of the greatest discouragements, developing the property itself, and now it is the richest company in the world, perhaps, and plenty of riches still left.

I always feel suspicious that there is something unhealthy about companies that begin by subletting and subselling. It always makes me suspect that either they must be wanting in faith in their own property, or in want of money; or distrustful of the competence of their means. It is usually a sign of weakness. If Oscar turns out anything like the success expected it will be easy to pay grand dividends, and also to gradually increase the capital by issue of shares to the existing shareholders at par, or by reserves formed out of revenue. I should be glad if you could find room for this letter on Oscar, as I feel rather strongly on the subject, and have good reason for doing so.—*Park-place, Dec.* 29. XINGU.

CHONTALES MINING COMPANY.

SIR,—At the meeting of this company on Monday, the minutes having been read, the noble Chairman went into details respecting the property as to what portions had been worked during the year ending June 30, 1884, and expressed his and his co-directors' confidence in Mr. White. In my reply I drew the attention of the shareholders to the position in which a manager of the Chontales Mines is placed, isolated from society, that he is in possession of a large property without anyone to overlook him, and the necessity of some steps being taken to overcome that difficulty. I referred to Mr. Belt, and the heavy returns he made in the earlier part of his engagement, being of an active turn of mind he devoted not a small portion of time in collecting specimens that formed the basis of his work published "On the Natural History of Nicaragua." Mr. Smeddle on entering upon his duties gave the most satisfactory returns of any manager before or since from 4½ dwts. of gold to the ton. He gave a remunerative profit for some length of time, but circumstances occurred which led to his removal. Mr. Danby, who followed, during the 12 months he was manager gave on one solitary occasion a profit of 16*l.* for the month, losses being sustained the other eleven. He is followed by Mr. White, and the new broom sweeps clean, the quantity of ore treated is nearly double the quantity crushed by Mr. Danby of gold, more than the preceding manager for 16 months, averaging over 5 dwts. to the ton.

Some time after Mr. Bell-Davies visited the property, and drew up a report, which the shareholders had to pay 1000*l.* for. What I contend is with the great confidence the directors have in Mr. White and his ability, who having been for some years living on the property, brought in contact with the miners who had worked the various portions, that his opinion ought to have been equal to the occasion; the effect would have been of economising our capital. March 1, 1881, Mr. Bell-Davies' report is issued, and the directors decide to act upon his suggestions before entering that part of the level where the rich shoot was found a few days previous. It would appear that the 20,000*l.* new capital was nearly exhausted. Mr. White had a letter of credit available for 200*l.* with not a small amount of dollars. At the same time he sells our pneumatic stamps and some of our stores. I have asked the directors repeatedly the name of the purchaser, and what the stores were, and what amount was paid for them, and whether he worked a mine in the Chontales district. I fail to see it accounted for in the annual account.

On the table at the meeting was a map supposed to be the position of the San Antonio level with the old workings (received in December) from whence the 20,000 tons of rich gold bearing ore was formerly taken, compared with the tracings I took of the plan of operations received Nov. 12. I ask the question, does Mr. White understand mensuration in the November plan. He is about 20 ft. from the old workings, whilst in the plan exhibited he is about 160 ft. There has not been activity shown by the manager in driving the San Antonio level two months consecutively; nothing was done taking the men away one month, the other month he has no dynamite. The certainty of meeting with equally as rich ore as was formerly taken out there can be no doubt, and is as certain as was meeting with gold in the rich nail at Consuelo, and with the time the manager has had at disposal long ere this the mine ought to be making substantial returns. I expressed an opinion as to a manager being paid a fixed salary—say 250*l.*; what he gets above that let him work for the shareholders as well as for himself. Whilst he gives his time the shareholders have found the money; put the one in one scale the other in the other scale, and there ought to be as much importance attached to the capital provided as to the manager's time. Under the present circumstances, receiving 550*l.* per annum, whether the shareholders get any interest for their money, he (the manager) is an independent man. The question of want of confidence would be shown if I were elected as a director was stated in the circular issued by the directors with the directors' report. I gave them to understand that our property was nearly 100,000*l.* less in value than when the directors of the late and present company took the management of our property, and that Mr. W. Bell-Davies in his report had stated that from the yield of gold and quantity of tons crushed that it ought to have been a paying-going concern from its commencement up to the time of his sending in his report.

The next part of the business was the choice of directors. The gentleman who proposed me, after Mr. Hill had been, referred to the interest taken by the shareholders on my behalf, and that proxies, amounting to nearly 30,000, had been sent to me; and amongst the large shareholders was one of the largest. The Chairman, asked his name, Mr. Truran stated the proxy had been revoked, and handed in a letter from Dr. Bradley, which was read, and finished by stating that being the last proxy supposed that it would take precedence of the first sent in my favour. With the withdrawal of 8904 votes I would not risk an election, and immediately left the room. On my return to Bristol I found a letter waiting for me from Dr. Bradley, and I will leave the shareholders to form their own opinions as to the course pursued by the secretary or the directors. My letter bears date Dec. 27, 1884, which states that he has received a telegram from the office to-day. My proxies for nearly 28,000 votes were due at the Chontales office at the morning's delivery. Examining the names of shareholders they would see the name of Dr. Bradley; hence the course pursued. And from the contents of telegram has every reason to believe that if I am elected a director the entire board would retire, and at the present time very reluctantly withdraws proxy given to me.

What right has the secretary or the directors to interfere with my proxies when having once been delivered at the office, especially when the secretary knew that renunciation of a former proxy was too late to a resident in Northumberland, and that a new proxy could only be overruled by the personal attendance of the party entitled to vote. It will form a question of investigation, and if the secretary has, on his own responsibility, forwarded the telegram, being the paid servant of the company, he stands committed, and the sooner his services are dispensed with the better. For myself, I should be glad to see some energetic large shareholder call an extraordinary meeting, and I would give my support for him to take a position on the board. No time should be lost; we have money at the present time, which will not last long, and it may not be too late. With the present management the amount paid for cost in London for the past 12 months might be considerably reduced. The amount I see is 590*l.* 5s. 4d. The amount paid the secretary would bear reduction, at any rate until we became a dividend-paying company; he has had some thousands of our money. I will repeat again that no time should be lost in calling an extraordinary meeting.—*Exchange, Bristol, Dec.* 31. WILLIAM BALL PALMER.

USE OF GAS AS FUEL.

SIR,—I have read with much interest the leader in the Times of Dec. 18 on London soot, in which special reference is made to the remedy suggested by Colonel Shakespear and Mr. Pridgin Teale. It is there pointed out how the existing open fires may be fed so as to economise fuel and minimise soot and smoke. No doubt much might be done in this direction by adopting the methods advocated by both of your correspondents. There is, however, one method just touched upon by Mr. Teale, but not referred to, which, in my humble opinion, would do more than anything else to rid not only London but all other towns of that all-pervading and destructive nuisance, soot and smoke. In closing his letter Mr. Teale says:—"Gas may be the smokeless fuel of the future, but of a future which is not yet close at hand." If not, why not?

Never in the history of gas making has gas been so excellent in quality and so cheap as it is at the present time; and never has there been such a development of inventive skill in the production of useful appliances for the utilisation of gas fuel both for domestic and manufacturing purposes. The first great impetus to the application of gas for cooking and heating was given at the Great Exposition held at Paris in 1878. Presumably one of the chief reasons why the attention of gas manufacturers was directed to an extended use of gas for purposes other than as an illuminant was that the wonderful discoveries, just then reported, of Mr. Edison and other electricians startled, and, for a time, scared the gas companies and their engineers. They then began to perceive that there were other outlets for gas above and beyond lighting, and their attention was naturally devoted to the supply of gas for all heating, cooking, and manufacturing purposes.

One of the most important applications of gas since that date is its use in the working of engines, or the production of motive power, the necessity for steam-boilers being thereby entirely dispensed with. So great has been the demand for gas-engines, that my neighbours, Messrs. Crossley Brothers, have delivered up to the present time more than 15,000 of their Otto engines alone. Gas is now extensively used for iron smelting and steel converting, in the manufacture of glass, and in generating steam in connection with large industrial operations. At Carnforth, Landore, Swansea, and elsewhere, iron and steel are treated entirely by gas as fuel, and at some of the largest collieries in the North of England the gas is conducted from the coke ovens to the furnaces and boilers, and so utilised in generating steam in lieu of coal firing. I could name very large works in Manchester and other places where gas only is used in the production of steam-power. It is found to be economical and effective, and less destructive to fire-bars and boilers than the coal fire. At the same time there is an absence of smoke and soot. I firmly believe, with the late Sir William Siemens, that the time is at hand when the use of coal fires for producing steam will be altogether abandoned. The present extravagant consumption of coal, partly, possibly, because it is very cheap, is nothing less than a wanton waste of the latent energy and reserve forces of our country.

There are but three natural products in Great Britain of which we have sufficient for our own requirements and something to spare for exportation. These are coal, iron, and salt. Our coal supplies are being exhausted at the rate of over 160,000,000 tons annually. At this rate, and the output is ever increasing, the time must come when our great subterranean coal store will be practically used up. Coal is not now being formed, and cannot be grown as crops of corn or grass. Coal consumed is destroyed; not so iron, however, which can be used over and over again. When prices are high coal is economised, and we then hear much about the limited duration of our coal supplies. Now that it is cheap we hear little or nothing on the subject. It is I believe a fact that in the use of coal for firing steam-boilers not more than 10 per cent. of the energy or heating power is utilised. The remainder—90 per cent.—is lost in smoke, soot, and wasted heat. In open fires in dwelling-houses it is said that not more than 3 per cent. is really utilised. Surely it is high time that steps were taken to diminish this wilful waste, which may lead to woeful want. It is this waste which produces the soot and smoke which pollute the atmosphere, are so injurious to health, and destructive to vegetation, works of art, buildings, &c.

The more general use of gas as fuel for all purposes will hasten the realisation of the picture of "what London might be if its perennial pall of smoke were annihilated." That it is possible finally "to emancipate London from that pervading grime which makes life so intolerable to all who have not fallen from their native sense of cleanliness" is evident from the practical experience of many who have tried the experiment of gas instead of coal for heating purposes. Among these I would mention Mr. Thomas Fletcher, of Warrington, who has done so much to promote the substitution of gas for coal fires. . . . ELLIS LEVER.

Culcheth Hall, Bowdon, Cheshire.

MINING IN SPAIN—ASTURIAS.

SIR,—In addition to the mines and deposits of iron ores noticed in my last letter, there are an abundance of others, both of iron and manganese in this province. Near Vega de Rivadeo, there is a very extensive deposit of rich crystallised carbonate of iron; but this is spoiled for utilisation, without being first calcined, by small spots of pyrites contained in it. Some parcels of it have been shipped to and worked at the Felguera Ironworks with poor results. Not far from this there are small deposits of pure iron peroxide, yielding 69·4 metallic iron. Several small cargoes have been shipped to Gijon and used in the local works. Near to a small fishing port called Porcia there are extensive lodes of grey magnetic iron ore, similar in quality and appearance to that of Marbella. During the late Carlist war when Bilbao supplies were cut off from these local ironworks they procured some from these mines. The results of the working of these mixed with the local ores as a burden was not found to be satisfactory; as soon, therefore, as Bilbao was opened they returned to the Sommorrostro deposits.

At Lumieres there is a bed of laminar red oxide about 30 metres thick. It contains from 45 to 48 per cent. of iron, 10 of silica, besides lime and alumina, and a small percentage of phosphorus. This mine is owned by Messrs. Duro and Co., of the Felguera Ironworks, and worked extensively for their own consumption exclusively. Their blast-furnace charges contain 45 per cent. of this ore, and the produce of their works is very good. As a flux they use a limestone conglomerate, having a fair percentage of magnesia. This conglomerate exists in abundant beds in the district. The phosphorus is almost completely eliminated in the blast-furnace. Assays of the pig produced proves this. It is rendered still more evident by the results obtained in the puddling and finishing processes. Take, for instance the manufacture of hoop iron, which is thus effected.

No. 3 pig-iron is charged into a puddling furnace; the charge weighs 5 cwts. The puddling is exclusively effected with small coal (slack). The furnace is fettled with a pure red hematite or sommorrostro ore. The pig is melted, then boiled, puddled, worked, and balled into four balls when working fine iron, otherwise three. The ball is taken out and slightly hammered to expunge a portion of the slag, and roughly to shape the mass. It is then returned to the furnace, and exposed to a reducing flame, until the remaining three balls will have undergone the same operation, when it is again taken out and well hammered. If the hammering had been done quickly it is taken direct to the rolls; if there has been any delay in the hammering it is again returned to the furnace and heated to welding heat before rolling. In rolling it is passed through from seven to ten grooves, according to sizes required. The bar is then sheared into short pieces or billets adapted to the weight of the hoop required. These are separately charged into a reheating furnace, to the number of about 30, heating to a welding heat and rolled, the result being a fine ribbon of hoop iron from each one, perfectly free from flaws, and with clean smooth edges.

Hoop-iron is worked in this way, measuring 10 millimetres wide, 1 millimetre thick, and 20 metres long. In this operation the most of the work is effected in the puddling-furnaces. The result of each furnace is about seven charges for 12 hours, wastage about 15 per cent., and a consumption of 1½ cwts. of coal per hundredweight of puddled bar produced. Nail-rods are manufactured in the same manner, in so far as the puddling is concerned. The puddling-furnace has the usual cast-iron plated bottom, and water tubes about 7 in. wide, in the form of a horseshoe, to form the walls of the bed. There is no dephosphorising element employed in the process. This must, therefore, exist in the blast-furnace, and consist of the limestone (flux) employed.

The Lumieres ore is cut and carried very economically. Work was commenced on the coast. The crop came out on a small deep bay, where loading can be effected during reasonably fine weather. The transport of the ore is effected in small steamers carrying 80 tons each, which leave Gijon for the mine one tide and return the next. A large stock is always kept in the deposit, which the company has at the railway station here. The are several similar abundant deposits of this ore still nearer Gijon than Lumieres, around Luanco and Candas. There are two small fishing ports to the west of Gijon also. The former, with a relatively small outlay, might be transformed into a safe harbour, were ships could always lie afloat.

All these deposits lie in parellel heavily tilted seams, cropping to the surface, and having a thickness varying from 4 to 10 metres. The produce of several of these would be shipped at Luanco, but a jetty would have to be constructed. That of the others would be shipped at Gijon. Their successful working would necessitate the construction of a railway of about 3 miles, from Candas to the western side of the Gijon Bay, where ships drawing 25 ft. of water could load, always afloat. All this would, of course, necessitate a very considerable outlay, but the deposits are practically inexhaustible; and, after that such outlay had been made, the ore would not cost more than 2s. per ton on board. J. A. JONES.

Gijon, Dec. 27.

SUCCESSFUL COLLIERY OPERATIONS IN GLAMORGANSHIRE—SINKING EXTRAORDINARY.

SIR,—Colliery sinking is now being carried on in the Clydach Valley, in Glamorganshire, which is situated midway between the Rhondda and the Taff Valleys, upon property belonging to the Right Hon. Lord Windsor, the Chairman of the Barry Dock Company. The new colliery belongs to Messrs. D. Davies and Company, of the Ocean Collieries, Rhondda Valley, of which Mr. D. Davies, M.P., is the principal partner. The company of the new colliery will henceforth be known as Messrs. Davies, Scott, and Company (Limited). The company have secured a large area of coal joining the River Taff on the south, the Penrhiwciber property on the west, the Clydach river on the west, and an unlimited area to the north.

The contract for sinking was entrusted to Messrs. W. R. and John Beith, mechanical engineers and contractors, who sank the Treharris Collieries, Treharris; Pochin Colliery, Tredegar; Cefn-Pennar, Mountain Ash, and several others in South Wales and Monmouthshire. The site of the colliery is called the Black Rock, situate in the centre of the valley, and the seams to be worked are the Aberdare Four-feet, the lower measures, and the Six and Nine-feet seams. The first sod was cut on June 16, 1884, by Mr. Morgan Joseph, the mining engineer to the company, and one of the partners, the contract to be completed in two years from its commencement; and up to Dec. 16 a depth of 201 yards has been sunk, which is considered sinking extraordinary, as the contractors had to go through 100 yards of Pennant rock above the No. 2 seam. The No. 2 seam was struck a little over 100 yards from the surface, and the No. 3 at 192½ yards. The whole of these operations have been carried out with the Power drills, patented and manufactured by Messrs. J. Foster and Sons, of Preston. It is confidently expected that the contract will be completed in 18 months, leaving six months to the good. This extraordinary progress is, perhaps, without parallel in mining operations in South Wales. The upcast pit was commenced on Oct. 13 last; and up to the time of writing this report (Dec. 23) a depth of 94 yards has been sunk, this distance being through Pennant rock. At this depth the Rhondda No. 2 has been struck. Mr. Joseph is to be congratulated on the completeness of all his arrangements, and the contractors upon the marvellous success achieved. The contractors have had erected electric plant, supplied by Mr. W. H. Massey, Twyfodl, Consulting Engineer to Her Majesty the Queen's Household. The lighting is done by incandescent lamps in groups of 8 to 4 of 20-candle power each. It was first lit on Dec. 22. This will enable the contractors to further expedite the work, as operations can now be carried on with as much ease by night as by day. The electric machinery was erected under the personal superintendence of Mr. George Beith, the agent of Mr. Massey in South Wales.

The sidings to the colliery are all completed off the Clydach branch of the Taff Vale Railway Company, and the Messrs. Davies and Company are busily carrying on preparations for erecting permanent boilers, chimney, and winding-engine. A building society at Cardiff are about proceeding with the erection of 200 workmen's houses, the plans of which were approved of by the Mountain Ash Local Board a fortnight ago. The colliery, when in full operation, will afford employment for at least 2000 men, raising 2000 tons per day, which will go a long way to supply the wants of the ships that will put in for coal at the Barry Dock. C. MARK LEWIS.

Tredegar, Dec. 29.

GOLD AMALGAMATION.

SIR,—By the courtesy of the directors of the United States Mint, at Washington, I have received the last report of the Production of Gold and Silver in the United States. Under the head of Davidson County, North Carolina, there is reference to the Conrad Hill Mines. After referring to the production of copper at the mine the report says:—"The mill of 20 stamps has been remodelled and its efficiency increased. The copper amalgamating plates ordinarily in use have been in part replaced by Moon's (misprinted by mistake Moore's) wave plate and amalgamator, which has proved of great utility in saving gold. Comparative runs made with this apparatus, and with copper plates, and also assays of tailings resulting from each method employed, show that the wave plate amalgamator is of superior efficiency." This report confirms all previous statements of its doings at those mines where it has been constantly at work since Sept. 18, 1883, a period of 15 months.

In a very short time I hope and believe I shall be able to report of similar doings at another large mine in America. On the subject of the amalgamation of gold I would remark in answer to your correspondent "T. C. B.," whose letter appears in last week's Journal, that every statement that I have made has been the result of much thinking and numberless practical experiments extending over nearly 30 years. I aimed at producing a machine that should save nearly all the gold. The working at Conrad Hill proves that from complex ores the machine has saved 90 per cent. of the gold. My next aim was to produce a machine that should be inexpensive to work. Mine can work in tailings, when the motive power is employed for it above, at a cost of 1s. per ton at the maximum. It will work for years without needing any repairs, and it can be stopped, cleaned out, recharged with quicksilver, and got to work again, by any ordinary labourer in 20 minutes. I have thus, I think, arrived at a very close fulfilment of my hopes and aims. HENRY MOON.

Canonbury, Jan. 1.

COMPARATIVE RESULTS OF COPPER ORES SOLD IN 1883 AND 1884.

SIR,—In contrasting my annual summary of the returns of copper ores sold during the past year from the mines of Devon and Cornwall it shows a considerable reduction on being compared with the sales of the previous year, and without some improvement on the standard and price of copper the new year's returns will present a more serious aspect; the present price of ores as sold at the last sale of 7s. 2d. per unit being the lowest known in the annals of mining, and copper mines must eventually succumb to the existing depression. I find the total quantity of ores sold in the year 1883 amounted to 39,375 tons; at an average produce of 6¼ per cent.; average standard 97*l.*, price per ton of ores 3*l.* 6s.; fine copper, 2298 tons 6 cwts. amount of ore, money realised on total sales, 126,067*l.* 18s. 6d., whereas the past year gives the whole quantity of ores sold as 37,306 tons, at an average produce of 6 1-16th per cent.; standard, 87*l.* 9s.; price per ton of ores, 2*l.* 15s.; fine copper, 2208 tons, 9 cwts.; total amount of ore money, 99,085*l.* 4s. 6d.; showing a diminution of 3-16ths on the produce; 9*l.* 11s. on the standard; 11s. per ton on the copper ores; 90 tons, 11 cwts. on fine copper; 2069 tons on the ores; and the aggregate amount on the sales during the year of 26,982*l.* 14s. I annex a list of 20 mines selling copper ores during the past two years, showing the increase and decrease on their executive returns:—

Mines.	1883.	1884.	Increase.	Decrease.
Bedford United	1,496	1,985	489	—
Devon Consols	10,633	9,912	—	721
Devon United	*nil*	406	406	—
East Caradon	274	164	—	110
Gawton United	545	448	—	97
Glasgow Caradon	915	480	—	435
Gunnislake	2,668	1,864	—	804
Holmbush	1,316	1,605	289	—
Levant	1,413	1,520	107	—
Marke Valley	1,626	495	—	1138
Mellanear	6,748	6,879	131	—
South Tolcarne	*nil*	515	515	—
New Cook's Kitchen	349	409	60	—
Prince of Wales	428	333	—	95
South Caradon	2,802	3,740	948	—
South Devon United	1,510	1,060	—	450
Violet Seton	150	116	—	34
West Caradon	370	265	—	105
West Seton	378	216	—	162
Wheal Crebor	2,524	2,917	393	—

M. W. BAWDEN.

Mining and Assaying Offices, Liskeard, Dec. 31.

CORNISH MINING, AND MINING THEORIES.

SIR,—A very discouraging view of Cornish mining was given under the head of The Present Position of Cornish Mining, in the West Briton of Dec. 18. Now, Sir, I will venture to state that mining in Cornwall is not nearly so discouraging as many people consider, and as the darkest cloud has a silver lining so has Cornish mining. Many have been anxiously looking and hoping for the cloud of encouragement, but it has not put in an appearance. The reason is with ourselves; we do not put our shoulder to the wheel in the proper direction. You remind us in your paper of the many rich mines no longer at work. We must, to start fair, put this very reasonable question—What was the reason of their being rich? We are bound to consider the cause and effect, and I will venture to assert, without fear of contradiction, that every good mine idle, and also at present working, was, and is, made productive by a secondary element (not sexes, as stated in the *Mining Journal* in February, 1882, by Mr. J. Van Cleve Phillips, of America). Secondary elements are cross-courses, caunter lodes, elvan courses, side lodes dropping in with the east and west lodes, "guides," as termed in St. Just district, the junction of two strata of ground, as killas and granite, &c.

I have not been idle in endeavouring by manual labour to prove my theory to be a correct one, first by finding an east and west lode, a caunter forming a junction with it; and in connection with the elvans, having sunk first on the caunter to a depth of about 6 fms., and driven about 2 fms., lode about 2½ wide, sunk on the east and west lode about 7 fms., the caunter lode being on the south of east and west lode; and having seen it first in the north or hanging-wall of lode, had to drive south for the footwall and caunter. We have seen about 10 ft. of the width of the lode, and up to the present no appearance of the caunter or footwall; ground hard, from 10*l.* to 12*l.* per fathom, with branches of copper running through the lode towards the caunter. I am very much grieved to find I cannot go further for want of funds, having expended my all. I am quite satisfied that when the footwall of the lode is seen in connection with the caunter there will be found a branch of copper to pay for the outlay, and open out a second Great Wheal Alfred, and where hundreds of our ill-fed miners will earn a livelihood for years to come.

I have proceeded thus far to endeavour to prove that mining is not so uncertain as it is generally considered, and to make it an inductive science. The inhabitants of Cornwall—99 of every 100—assert that Cornwall mining has seen its best days, and that we must find a new industry for Cornwall. I for one beg to differ from them, and request the short-sighted ones to find the new industry. In the meantime my friends will please assist me to open on the many promising lodes one at a time, and they are to be found in every parish, with but few exceptions. The one trial, I ask no more, and the affair will be self-supporting, and Cornwall will witness again as bright days as we have ever seen.—*Hayle, Dec.* 24. JAMES WILLIAMS.

DEPRESSION OF THE TIN TRADE—RED RIVER.

SIR,—Knowing the depressed condition of the mining industries I have been expecting some of your contributors to suggest some practical remedies for bettering matters. We will take tin mining, for instance, as everyone connected with tin mines must know what an immense waste of ore there is going on continuously. This being so, how is it that such is allowed to continue. There is, no doubt, much prejudice to overcome in the matter, as the old school of miners say these things have been in use in my great-grandfather's time, and why should we not continue using them still? I have heard expressions used similar to the above; but these arguments cannot be tolerated in these days, for sooner or later this matter of ruinous waste must be stopped, as, if it is not done (in the face of the growing foreign competition) nearly all the tin mines in the country will have to be closed or worked at a loss, as is the case with too many tin mines at present. As to the loss going on I will simply mention the Red River, and the amount of tin that has been intercepted there within the last few years. I have no doubt there are many mines where a third of the ore is lost; I have been told of mines where one-half is lost, but of course cannot vouch for this, but have it from very good authority. Now, the next question that arises is this—Can this ruinous waste be prevented? I say most emphatically it can. This I have proved over and over by experiments that I have been making for a considerable time past; and I can safely say further that with proper apparatus and appliances the loss of ore would be so small as not to be worth mentioning, whilst the cost of dressing the ore could also be reduced, thus effecting a double saving.

The simple question to be decided is this—Can the ore that now escapes be bought at the mine as well as at a distance away? Common sense says it can, with proper apparatus and appliances, that would soon pay their cost in the immense saving that could be effected, and I can safely say that many mines that are not now paying dividends could, by adopting the improvements mentioned, be made to pay dividends. If we only look around us at gas-works, breweries, flour mills, &c., we see in nearly every business as well as these named that waste is being put a stop to, whilst in tin mines there seems absolutely nothing worth mentioning being done in this direction; but to show what can be done with only one part of the apparatus, I received a letter six or eight months since showing that a saving of 6*l.* 5s. per ton was effected, or in other words, the ore was more valuable by the above amount per ton; so that I have no hesitation in saying that, by adopting the apparatus and appliances I have alluded to, there would be a saving, taking it all round, of 12½ to 40 per cent.—*Tavistock, Dec.* 30. E. DAVIES.

SHROPSHIRE LEAD MINES.

SIR,—It is a pleasure to us to say that the South Roman Gravels Company have paid their men the whole of their back money for wages, and have put the men to work again; and we are informed that the company intend putting up an engine on the new shaft, and sending it down at the fastest possible speed until we strike the runs of ore coming in from the adjoining mine. Their perseverance in these dull times is very praiseworthy, and we hope and believe they will be rewarded with a lasting rich mine.

The Tankerville Great Consols Company have paid their workmen 2s. 6d. in 1*l.* lately, making, with the 5s. previously paid, 7s. 6d. in 1*l.*, leaving 12s. 6d. in 1*l.* of their wages for the last two months the mines were worked still owing. We have been told that the liquidators are getting in the outstanding calls, and that the men will be paid the whole in a short time. The distress is being more severely felt now than ever, and we hear that the relief committee have funds in hand, but that, because they were found fault with before, they cannot decide which would be the best means to adopt in dealing out the relief so badly needed. MINER.

SCIENTIFIC RECREATIONS FOR PRACTICAL MINERS.

SHORT, POPULAR, INSTRUCTIVE PAPERS FOR WORKING MINERS.*

BY EDW. DAVID HEARN, M.A., D.C.L., ETC.

The series which we commence to-day will be continued in the *Mining Journal* at the rate of from one to two columns each week.

It must be distinctly understood that the papers are intended, should they be read by students, to assist and facilitate the study of the usual text books, and not as a substitute for those books. But the principal object is to give in readable form to working miners who have not had the opportunity of receiving a systematic course of instruction, and whether they be engaged in metalliferous mines or collieries such an outline of elementary mathematical and general science as will be useful in enabling them to help themselves when preparing for the examinations for Certificated Managers or seeking to qualify themselves for captains, managers, or other officers of metalliferous mines. We subjoin the first paper on Chemistry, because the mathematical papers are not quite ready.

CHEMISTRY.—NO. I.

The success of so many of the processes daily carried on in connection with industrial art depends upon the careful consideration and judicious application of the laws of chemistry that most practical men will appreciate the importance of a knowledge—of, at least, a sound general knowledge—of the leading principles of that beautiful and useful science. Even apart from its practical value the study of chemistry affords so large an amount of real pleasure that once entered upon it is not likely that it will be willingly abandoned. The science of chemistry is entirely dependent upon experiment, and as it is intimately connected with every operation of animal and vegetable life, as well as with industrial processes, we shall be enabled to recognise the enormous extent of the domain of chemistry in almost everything we see or touch. To acquire some general notions of chemistry is by no means difficult, and with a little perseverance we may be enabled, amongst other things, to ascertain not only the reason that certain mixtures or combinations take place but also the proportions of the several ingredients of which the combination is formed. Most of us will meet with many opportunities of advantageously applying whatever knowledge of chemistry we may possess, although to make an analysis with any chance of success it requires, as Dr. Noad very truly states in his "Manual of Chemical Analysis," the possession of certain qualifications, such as habits of strict order and scrupulous neatness; dexterity of manipulation; a firm conviction that the laws of Nature are unchangeable, and that variations in experimental results must consequently imply either a non-fulfilment of certain necessary conditions or some error in manipulation; and some others perhaps scarcely less indispensable.

As it would obviously be impracticable to attempt with the means at present at disposal to prove them, we must assume the accuracy of the statements made until we have the opportunity of verifying them for ourselves. The most ready, although perhaps not the most amusing, way to attain the object we have in view—that of learning all we require in the shortest possible time—will probably be to glance at the theory first, and then turn to the practice. All bodies, then, are either simple or compound; but with regard to this statement it is necessary to observe that the only ground existing for the distinction is that science has not yet discovered the means of decomposing those called simple or elementary, although it does not at all follow that they all incapable of decomposition. These elements are about 60 or 65 in number, about four-fifths of them being metals and the remainder non-metallic substances. Certain of these elements combine with each other to form compounds, and, again, these latter frequently unite to form other compounds—of course, more complicated. It is fortunate, however, that these combinations always take place according to well understood and immutable laws, which can be quickly learned. But to enable us to comprehend these laws with facility we had better first provide ourselves with a table of the elements, as a reference to it will often prevent much unnecessary repetition. The subjoined will give as much information as we shall for the present require:—

Name of Element.	Symbol.	Quantivalence.	Combining equivalent.	Nature.	Specific gravity.
Aluminium	Al	III	27·5	e	2·580
Antimony (stibium)	Sb	III	122	g	6·700
Arsenic	As	III	75	g	5·700
Barium	Ba	II	137	d	4·000
*Beryllium	Be	III	14	e	·
Bismuth	Bi	III	208	f	9·776
Bromine	Br	I	80	b	2·960
Boron	Bo	III	11	b	1·183
*Cadmium	Cd	II	112	f	8·640
*Caesium	Cs	I	133	c	·
Calcium	Ca	II	40	d	1·570
Carbon	C	IV	12	b	3·500
*Cerium	Ce	II	92	e	·
Chlorine	Cl	I	35·5	a	2·440
Chromium	Cr	III	52·5	h	5·900
Cobalt	Co	II	58·8	f	8·500
Copper (cuprum)	Cu	II	63·5	f	8·950
*Didymium	Di	II	96	e	·
Flourine	F	I	19	—	?
Gold (aurum)	Au	III	196·7	i	19·300
Hydrogen	H	I	1	a	·0693
Iridium	Ir	IV	198	i	18·680
Iodine	I	I	127	b	4·948
Iron (ferrum)	Fe	II	56	h	7·790
*Lanthanium	La	II	92	e	·
Lead (plumbum)	Pb	II	207	h	11·333
*Lithium	Li	I	7	c	·593
Magnesium	Mg	II	24	d	2·240
Manganese	Mn	II	55	h	7·250
Mercury (hydrar.)	Hg	II	200	i	13·596
*Molybdenum	Mo	VI	92	g	8·600
Nickel	Ni	II	58·8	f	8·333
*Niobium	Nb	IV	97·6	g	·
Nitrogen	N	III	14	a	·9713
*Osmium	Os	IV	199	g	10·000
Oxygen	O	II	16	a	1·106
Palladium	Pd	II	106·5	i	11·300
Phosphorus	P	III	31	b	1·833
Platinum	Pt	IV	197·4	i	22·000
Potassium (kalium)	K	I	39	c	·865
Rhodium	Rh	II	104	i	10·650
*Rubidium	Rb	I	85·5	c	1·520
*Ruthenium	Ru	IV	104	i	11·400
Selenium	Se	II	79	b	4·320
Silver (argentum)	Ag	I	108	i	10·498
Silicon	Si	IV	28·5	b	·
Sodium (natrium)	Na	I	23	c	·953
Strontium	Sr	II	87·5	d	·
Sulphur	S	II	32	b	2·087
*Tantalum	Ta	IV	137·5	g	·
*Tellurium	Te	II	128	g	6·305
*Thallium	Tl	I	204	h	11·910
*Thorium	Th	IV	231·5	e	·
Tin (stannum)	Sn	IV	118	g	7·283
Titanium	Ti	IV	50	g	·
Tungsten (wolfram)	W	VI	184	g	17·600
Uranium	U	II	120	h	8·425
*Vanadium	V	VI	137	g	·
*Yttrium	Y	II	68	e	·
Zinc	Zn	II	65	f	6·861
*Zirconium	Zr	IV	90	e	·

With regard to this table it should be at once explained that in stating the specific gravity of oxygen, hydrogen, chlorine, and nitrogen (these being gases) common air has been taken as unity; it must, therefore, be understood that chlorine, for example, is 2·44, or nearly 2½ times heavier than *common air*. For all the other elements water has been taken as unity; therefore, gold is 19·3, or about 19½ times heavier than *water*. The column showing the nature of the elements is well worthy of the attention of practical men. The elements marked *a* are the non-metallic radicles which exist alone as permanent gases—of these we shall learn more presently; *b*, are the solid non-metallic radicles; *c*, are the metals of the alkalies; *d*, are the metals of the alkaline earths; *e*, are metals of earths; *f*, are metals forming basis, but not acids; *g*, are metals forming weak acids and weak bases; *h*, are metals forming strong bases and acids; and *i* are metals the oxides of which are reducible by heat. The elements marked with an asterisk are of comparatively little importance. It is scarcely necessary to explain that matter exists in three conditions—solid, liquid, and gaseous—and that by the application or abstraction of heat matter may be changed (almost always) from one of these conditions to another. Perhaps the most familiar example of this change is that afforded by water, which by the application of heat assumes the gaseous condition, and becomes dry steam; whilst by the abstraction of heat from water the opposite change is produced, and the liquid becomes a solid—ice. A similar change of condition takes place when steam is condensed, when ice, lead, or iron is melted, and in the innumerable other instances which are continually presenting themselves to our notice.

Matter may also be considered as possessing certain general properties, of which some are physical, some chemical. When it is merely the physical properties of the ingredients that cause them to unite no change is produced in the constitution of the matter affected, and the result is said to be a physical or mechanical combination, or more usually a *mixture*; but when the union is due to the chemical properties of the ingredients a complete change is produced in the matter affected, and the result is said to be a chemical combination or a *compound*. Iron filings and sand can be made to form a mixture; the combination of three measures of hydrogen with one measure of nitrogen forms ammonia, which is a chemical compound. The distinction between mixtures and compounds must be carefully remembered. We have now to deal with chemical compounds only; our first care will, therefore, be to learn the three laws of chemical combination:—

1.—Each chemical element has its own combining-equivalent, such combining-equivalent being the weight in which it combines with other elements.

2.—All chemical compounds are definite in their composition, and the proportion by weight of the elements is always the same in the same compound.

3.—If there be two or more compounds of the same elements the weight of the elements in one compound bears a simple proportion to that which exists in the other compounds.

We shall now begin to understand the use of our table. The symbols given in the second column are merely abbreviations of the names of the elements, used as a kind of chemical shorthand; the Roman numeral representing the quantivalence of the elements indicates at once the usual number of atoms of each element requisite to take part in the formation of a compound, and likewise how many standard atoms can be saturated by the quantity of each element which we have designated its combining-equivalent. We say the "*usual* number of atoms requisite to form a compound," because the quantivalence of an element is not always invariable—that is to say, the quantivalence of the same element may be 2, 4, 6, or 8 for example, or 1, 3, 5, or 7; but it is rarely that odd and even quantivalence is mixed. The quantity or weight (let us say the number of

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grammes) representing the combining equivalent of one element will combine with the quantity or weight representing the combining-equivalent of another element, and form two atoms of a compound. The importance of studying the laws of chemical combination, and the combining proportions of different bodies will be evident when it is considered that it is upon these that the peculiar process called analysis depends. Nor does it follow because we are unlikely to become analytical chemists that, therefore, a knowledge of the combining-equivalents of the elements will be useless to us—the practical man often attempts to carry out processes which, were he only to consider the combining-equivalents of the elements, he would know before he commenced must result in failure. This we will presently demonstrate.

The combining-equivalent of a compound is found by simply adding together the figures representing the combining-equivalents of the several elements of which such compound is composed. Take, for example, carbonate of soda which is written Na_2O,CO_2, and consists of one equivalent of soda with one equivalent of carbonic acid. Now the table gives 23 as the combining-equivalent of sodium, and as the quantivalence of sodium is 1 whilst that of oxygen is 2, it will be found that two equivalents of sodium will combine with one equivalent of oxygen to form soda—Na_2O. Therefore multiplying 23 by 2 we obtain 46 for the two equivalents of sodium, and adding thereto 16 for the oxygen we have 62 as the combining equivalent for soda. To find the combining-equivalent of the carbonic acid we proceed in the same way—the quantivalence of carbon being 4 and that of oxygen 2; one equivalent of carbon readily saturates two equivalents of oxygen. Adding to 12, the equivalent of carbon, 32 or twice 16 for the two equivalents of oxygen we obtain 44 as the combining-equivalent of carbonic acid. Again, by adding 44, the equivalent of carbonic acid to 62 the equivalent of soda we obtain 106 as the combining-equivalent of carbonate of soda. Now suppose we required to neutralise this carbonate of soda, which would it be preferable to use (assuming the price of each acid to be 1d. per 1 lb.) nitric acid or sulphuric acid? Look at the table of equivalents, remembering that nitric acid is written N_2O_5, and that the formula of sulphuric acid is SO_3. Finding the equivalents as before we learn that the combining-equivalent of the nitric acid is 108, whilst that of sulphuric acid is only 80; consequently, in the neutralisation of 106 lbs. of carbonate of soda we can do just the same work with 80 lbs. of sulphuric acid as with 108 lbs. of nitric acid; and this shows us that, the acids being at the price named, we should save, by the use of sulphuric acid instead of nitric acid, no less than 2s. 4d. upon every 106 lbs. of carbonate of soda neutralised, or at the rate of more than 49s. per ton.

In these calculations no notice has been taken of the circumstances that we have been dealing with double molecules, so that, in truth, the equivalent of each compound is just half that stated—carbonate of soda, 53; nitric acid, 54; and sulphuric acid, 40. All these little niceties will be explained hereafter, but it was thought desirable to show at once that the actual commercial advantage attaching to a knowledge of chemistry was quite sufficient to induce the practical man to study it, although he might have no wish to apply his knowledge except for his own personal benefit and in the particular business in which he is engaged. As it was indispensable to furnish a sound basis to work upon, the present paper has perhaps been less interesting than could have been wished; but if the information given be properly availed of the student will find that his onward progress will be smooth and pleasant, and that every step he takes will give him greater confidence in the firmness of his path.

THE LEAD WARRANT COMPANY.

In again writing on the Lead Trade it would be well to refer to the article in the *Mining Journal* of Nov. 15 last, where the writer mentioned what assistance and benefits the producers, brokers, and agents who deal in this metal would derive by working on the "Warrant System," and storing a part of their produce at times of over production. The Lead Warrant Company, whose sole object is to assist the lead producers in standing their own ground, has now been in working two years, and although some have supported the undertaking, and lead has been deposited to the extent of several thousand tons, still the low market value of lead, and the condition of producers taken together, must have to a certain extent prevented many from co-operating for a time.

The price of this metal appears to be on the advent of an improvement, and should such be the case the Lead Warrant Company should, it is claimed, now be used, and become very useful to the lead trade, especially producers. The prices charged by this company are as low as could be possibly arranged, and every facility for storing pig-lead has been provided to accept either large or small consignments.

The warrants issued for the lead may, it is thought, be found very useful, as advances equal to a large percentage of the value of the lead may be easily negociated. Only those who have had recourse to warehousing hitherto can imagine the excessive charges that some wharfs make. It is the producers who may obtain the greatest benefit from the "Warrant System," and for them it was introduced. During the last two years mineowners have not had much opportunity for deviating from the ordinary style of transacting their business, which has ruined a great many, and if things do not alter, other mines will be closed. They do not appear to understand that this system, in the writer's opinion, offers them more independence and an inexpensive alternative course if the buyer should not offer a fair price. Now the depression appears to be near at an end, perhaps mineowners will think it is nearly time some steps should be taken for looking after their future interests, and it behoves all of them to do so, for although singly nothing can be done, co-operatively a great deal may.

If 75 per cent. of the producers throughout the world were to act in unison and support any movement in their favour, such as "The Lead Warrant System," a mutual benefit might be the result, but when the buyers know that so many tons will be offered during such a time, and that the consumption is only about on a par with what will be offered, they abide their time, well knowing that they can buy at their own price almost if they wait. The first essential step to take is to endeavour to obtain a remunerative price, after which every effort should be made to retain an even market. Competition, and over-production are the two causes mostly given to explain low prices, but the latter would be entirely overcome if the former were properly protected.

To the miserable competition, and the longing after business regardless of the profit which some men have, may be attributed the continued low price. As an instance of illegitimate competition reference may be made to the slate trade. During the last few years slate quarry owners have undersold one another until the price fell below what it cost to produce. At last one firm says—"We are prepared to lose so many 1000*l.*, and having plenty of money to fall back on, they await patiently their time until after several failures the prices improves a little. Those firms who are left working find it more profitable to come to terms, and the result is a meeting is arranged to fix prices. This we believe has already been done for 1885, and there is no reason why such should not take place in the lead trade. With consumption almost as large as production the result would bring a gradual return to prosperity, the reverse of which has been so generally felt in the year just closed."

COLOUR OF NEW SOUTH WALES GOLD.—This is usually of fairly deep yellow, being rather higher than Victorian, and not so light as much of the Southern Queensland gold, but occasionally specimens of very pale, and of very dark gold are met with. The quantity of silver present greatly affects the colour of the metal.

THE INSTITUTION OF CIVIL ENGINEERS.—A list of members corrected to this date contains the names of 1447 members, 1889 associate members, 508 associates, 20 honorary members, and 804 students; together 4668. The senior member of the Institution appears to be Mr. P. W. Barlow, F.R.S., who was elected an associate in 1826, and a member in 1845; but for full membership the senior bearer of that title is Mr. Thos. Elliot Harrison, of Newcastle, who was M.I.C.E. in 1834.

THE LONDON ACADEMIC UNIVERSITY.—No. II.

Assuming that the desirability of the federation of our technical, scientific, and professional schools is admitted, and having expressed the conviction that this federation is only practicable upon an entirely different basis from that proposed by the Committee for promoting a Teaching University for London, it becomes necessary to consider whether there is any practicable basis whatever. Our Law Schools do not reach perfection by a long way, and the same may be said of our Medical Schools, whilst our Technical Schools are decidedly bad; yet we have as large a proportion of first-class lawyers, first-class medical men, and first-class industrials and men of science, compared with the number of "polls" who graduate in the several faculties as is to be found in Germany, France, or elsewhere. The first-class men may have to acquire their knowledge in a rough and tumble kind of way it is true, but they learn far more thoroughly than those who study in schools where the curricula are theoretically more perfect. It was, and, indeed, still is the same in Nova Scotia the Churchmen, Presbyterians, Wesleyans, Baptists, and Roman Catholics, are each better instructed regarding the question from the points of view of the members of the various sects in the universities established by the several religious bodies mentioned than would have been practicable had they been annihilated and absorbed in the University of Halifax. To give any prospect of success it is essential that the denominational universities of Nova Scotia, and the different professional schools in London should be secured almost absolute independence as between themselves and their students, although they must necessarily submit to restraint as between themselves and the university of which they should form part. The parent university should occupy a position exactly equivalent to that occupied by the Federal Government of the United States of America, whilst each affiliated institution should enjoy all the separate rights which would correspondent with the rights of the separate republics (States) of which the United States is built up.

For brevity we will designate the Federal Council the University, and regard each affiliated institution—whether it be an Inn of Court, a Medical School, or a School of Science—as a College. The condition of affiliation should be the expressed acceptance of the federal control of the University. Each College would appoint one member of each faculty existing in the college to be a member of the Federal Council of the University for three years, the elections being so arranged after the first year so that there shall always be new members coming on by rotation and old members left on the Council. Then, as it is essential the degrees of the University should be recognised as indication of fair general knowledge, as well as of sound special knowledge, it should be provided that—"No student in an affiliated College shall count terms for a degree until he shall have passed, before examiners appointed by the Federal Council, an examination (the standard to be equal to that now fixed for matriculation in the University of London) in English Language, General and English History, Arithmetic and Algebra, French and German." This might be regarded as corresponding with "responsions," or the "little go," and would be the only examination which the University would conduct. Next comes the question of securing independence to each affiliated College, and maintaining a high standard for graduation in each of them. It is assumed that residence, or the satisfactory passing of stiff terminal examinations should be compulsory before graduation, or the whole concern would quickly degenerate into a paper university of the worst kind. Each College would be required to prepare a full syllabus of its proposed curriculum, and submit it to the Federal Council of the University, a sub-committee of whose members, specially acquainted with the subjects embraced in the curriculum, would decide whether the standard in each subject was reached, due regard being had as to whether the curriculum was intended for legal, medical, arts, science, or technical students; and it would only be by substantial adherence to the approved curriculum that the College would be empowered to grant the Testamur for a degree.

With regard to the terminal and degree examinations, they would be conducted by each college, but all papers set would have to be sent to the Federal Council of the University, as would also the answered papers after they had been dealt with by the College examiners, and in the event of the papers set being of unduly low standard, or of badly answered papers being passed, the students' degree would be disallowed, or the College would be disaffiliated according to the extent of the offence. Each paper would be valued up to 100 marks, and 75 marks would be required for a pass. The degrees would be conferred by the Chancellor, or his representative, of the University, the President of each College presenting his "sons" to receive the honour, and the obtaining of a degree should entitle the recipient to the associateship of his College, and to describe himself for example—B.A., King's College, London; or B.A., A.K.C., as might be preferred. Provision should be made for empowering the Federal Council to admit to ad eundem and to honorary degrees, in order that all competent professors should be permanently connected with the University; but these are mere details, which could be satisfactorily disposed of in arranging the full programme of the scheme. The essential point to be considered is how to secure close union and complete independence for the colleges, and the teaching of special subjects in the several schools, whilst maintaining so high a standard for examinations that the degrees granted will be respected everywhere.

ST. JUST UNITED.—At the meeting held on the mine on Dec. 23 (Mr. W. Holman in the chair), the accounts, showing a loss on the 16 weeks of 751*l.* 4s. 8d., were presented, and a call of 5s. per share made. The labour costs amounted to 2693*l.*, and merchants' bills to 830*l.* 18s. The tin sold, 66 tons 6 cwts., realised 3072*l.* The total balance against the mine was 1672*l.* 14s. 10d. The report stated that the Creampot winze, west of Bayley's engine-shaft, had been sunk 5 fms. below the 160 fm. level, and they were carrying the spar, and a small portion of the lode about 2 ft. wide, which was producing good stones of tin. They were going to cut through the lode at the botton of the winze to ascertain its size and value. The lode at the 160 was 14 ft. wide, of low quality. This bunch of tin from the first time it was met with at the 70 had altered several times in value. Communication has been made with the Cape Cornwall Mine, which has caused good ventilation, and the water from that part is flowing to St. Just United Mine. Some of the underground prospects since the last account had turned out equal to expectations. The sales for the coming 16 weeks are likely to be about 5 tons of tin per week.

DAY DAWN BLOCK AND WYNDHAM GOLD MINING COMPANY.—At the meeting at Charters Towers, North Queensland, on Oct. 6 (Mr. Thomas Mills in the chair), the statement of receipts and expenditure shows that 3332 tons 3 cwts. 2 qrs. of quartz were crushed during the half-year, yielding 9537 ozs. 1 dwt. 6 grs. of smelted gold, being at the rate of 2 ozs. 17 dwts. 5 grs. per ton, and giving a net return of 32,922*l.* 8s. 6d. The expenditure, under the various heads of wages, stores, machinery, &c., has been 9721*l.* 8s. 8d. The amount paid away in dividends was 22,200*l.*, leaving a balance in bank to credit of 149*l.* 4s. 10d. This, the directors' report says, you will no doubt deem a very satisfactory result of the half-year's operations, taking into consideration the large amount of dead work done in the different workings of the mine, more especially Nos. 2 and 3 shafts. From the former only two or three small crushings were taken, and from the latter none, owing to the works not being yet sufficiently advanced, and no machinery erected thereon. In conclusion, the directors are pleased to congratulate the shareholders on the continued success and prosperity of the company, and confidently look forward to a still larger measure of success in the future.

SILVER MINING IN NEW SOUTH WALES.—The population of Silverton, which a couple of years ago had no existence, now exceeds 5000, the town having large stores, hotels, a theatre, &c., and a weekly newspaper, the Silver Age. Large quantities of capital have been subscribed for working the mines, and there is every prospect of Silverton becoming one of the largest and most flourishing towns in the colony.

THE SALT SUPPLY OF THE WORLD—No. II.

British India, considering its vast extent, can hardly be said to be well supplied with what may be called inland salt. The bulk of this is obtained from the evaporation of the water from the Sambhur Lake and from the Punjaub Rock Salt Mountains. This extensive range of mountains stretches from the base of the Suliman Mountains, in Afghanistan, in an easterly direction, to the River Jailum, in the Punjaub. It is known to the natives in different parts by many different names; but among Europeans it has acquired the general term of Salt Range, from the great extent and thickness of the beds of common salt which it in many places contains. One is 200 feet thick, and the salt varies in colour from white to flesh colour and brick-red. In addition to the supply from these sources salt from the evaporation of sea water is obtained along thousands of miles of coast. But India, like North America, will take large supplies of salt from us for some time to come, and probably in increasing quantities.

Some remarks also on the production of salt from sea water are given. We now come to the English salt-producing districts, which, though very prolific, are of limited extent; but it will suffice to mention the chief centres of rock salt and brine springs in this country. These are Northwich, Middlewich, Winsford, and Sandbach, in Cheshire, the basins of the Rivers Weaver and Wheeloch, mainly forming the salt district; Stoke Prior and Droitwich, in Worcestershire, to which may be added Weston-on-Trent, in Staffordshire. At Duncrue, near Carrickfergus, in Ireland, there is an important rock salt deposit. At Middlesborough-on-Tees another valuable deposit of rock salt exists, and at Chester-le-Street, in Durham, is a brine spring. Indications of salt are also to be met with in Shropshire and Lincolnshire.

It is probable that the production of salt will be still further developed at the centres in Ireland, Yorkshire, and Durham, just above mentioned. It was not till as recently as 1851 that rock salt was discovered at Duncrue, when a trial shaft was being sunk in the hope of finding coal on the Marquis of Downshire's estate. Consequent upon this discovery new shafts were sunk by the Belfast Mining Company and Mr. Dalway, and the deposits have been worked ever since. Another winning was commenced in 1884.

The rock salt deposit at Middlesborough was only discovered in 1862, when Mr. John Vaughan, of Bolckow and Vaughan, bored for water on the south bank of the Tees, for feeding his steam-boilers, and struck the salt at a depth of 1200 ft. The firm subsequently endeavoured to work the deposit by means of a shaft, but soon abandoned it, on account of the heavy cost. In 1874 Messrs. Bell Brothers sank a bore-hole on the north side of the river, and found the salt at a depth of 1127 ft., or 73 ft. nearer the surface. This deposit exists in the palæozoic series, overlying the coal measures, and is about 3000 ft. lower and considerably older, geologically, than the Cheshire salt, which is found entirely in the triassic series of rocks. The theory of its formation is that the salt water, in isolated basins cut off from the sea, or communicating with it by narrow entrances only, was gradually concentrated, until it became saturated. The extent of the bed has not been ascertained, and all that is known at present is that it rises to the north and dips to the south. The thickness, however, as proved by a second bore-hole, put down by Messrs. Bell in 1881, is 65 ft., warrants the estimate that salt is present under Middlesborough in the proportion of 200,000 tons to the acre. In Cheshire the surface water trickles through the clay to the gypsum, and flows over the salt, which is thus converted into brine, and only requires being raised to the surface; but in the Middlesborough deposit the nature of the strata and the great depth preclude all chance of infiltration. It occurred, however, to Mr. Thomas Bell that the salt might be raised by allowing fresh water to flow into the hole and become saturated with salt, and then pumping out the brine without sinking a shaft. Accordingly the bore-hole was put down successfully by the rotary diamond drill; and it so happened that a portion of the lowest core was left at the bottom of the hole, leaving an annular space, which has served to receive the lower end of the lining tube. This latter is perforated with holes where it passes through the salt, and the greater portion of its weight is carried by a ring resting on the surface. An inner tube, perforated for a short distance at the bottom, is supported partly by a plate at the bottom and partly by girders at the top. There is an annular space between the two tubes, into which fresh water is allowed to flow. This water makes its way out through the holes in the outer tube, becomes saturated with salt, and rises in the inner tube, but only to such a level that the two columns bear the proportion of 10 to 12, that being the relation of the specific gravities of brine and water. The pump is, however, placed below this level, so as to avoid the necessity for suction. The pump, worked by an engine at the rate of 14 strokes a minute, lifts from 8 to 9 gallons of brine at each stroke. When the cavity in the salt bed at the bottom of the hole has attained a certain size, the following is supposed by Mr. T. Hugh Bell to be what takes place. A molecule of water descending the annular space between the two tubes reaches the upper cavity in the salt, and there finds saturated brine. It, therefore, no longer continues its downward course, but floats on the surface of the heavier fluid, having no tendency to sink until it becomes saturated by coming into contact with the undissolved rock salt. The cavity at the bottom is, therefore, filled with a solution of salt, saturated or nearly so with fresh water flowing along its surface, and which gradually becomes saturated in turn. The pump draws the saturated solution from the bottom of the hole, and makes room for fresh water on the surface, so that there is a tendency for the hole to become enlarged at the bottom, and assume the form of a very flat inverted funnel. The brine is pumped into a reservoir containing 500,000 gallons, and, roughly, between 500 and 600 tons of salt, the salometer standing at about 23°. Thence it flows into twelve shallow evaporating pans, nine of which are heated with coal, and three by the waste gases of the blast-furnaces adjoining, the temperature of the brine being kept at 170°. The salt crytallises in regular cubes, which float on the surface; and on each cube is formed others, until the whole mass becomes too heavy to float, and sinks to the bottom. Some difficulty was experienced in a thin pellicle forming on the surface, which prevented the crystals from falling, and also arrested evaporation. This was found on investigation to be due to gelatinous vegetable matter, which was present in the surface water used, but upon water from the Darlington Waterworks being substituted the difficulty ceased. Salt is taken out every other day upon platforms, called "hurdles," between the pans, and conveyed in barrows to railway wagons. A scale of sulphate of lime forms on the bottom of the pans, which requires removing at intervals, and also necessitates the laying off and thorough cleaning of the pans every three or four weeks. The 12 pans some time ago produced 360 tons a week of coarse salt suitable for curing purposes and for chemical works, table salt requiring to be crystallised at a much higher temperature. The firm are now turning their attention to the utilisation of the brine as it comes from the bore-hole, for making carbonate of soda. They are also making preparations for putting down another hole, to be ready in the event of the existing one failing, through a fall of the roof or the tube being destroyed.

The utilisation of the large deposits of salt that have been known for 20 years to exist in South Durham has been for some time in progress. The brine from the bore holes has been converted into salt, large quantities of which have been sent to some of the alkali works on the River Tyne. It has been sold at rates as high as that from Cheshire; so that, when the difference between the cost of carriage is borne in mind, the price of the South Durham salt must be profitable to its producers. It is impossible as yet to state what the effects of the utilisation of these deposits will be as they are believed to extend from Middlesborough under the River Tees to somewhere not far from West Hartlepool. If anticipations be realised there will be a great change in the position of the Tyne chemical trade. It will ultimately obtain cheap salt, and it is probable that on the low lying and not fertile shore between the Tees and West Hartlepool large chemical works will be soon erected.

DARLASTON COAL AND IRON COMPANY.—The eighth annual meeting was held at Birmingham on Monday (Mr. James Trees in the chair).—In moving the adoption of the report the Chairman stated that the balance-sheet showed a profit of 1465*l.* 15s., which,

although not much, considering the turnover of 33,000*l.*, was something like 700*l.* more than was made last year, when the turnover was only about 3000*l.* less. They proposed to pay off the arrears of interest due to the preferred debenture-holders, and also 5 per cent. on the debentures for the present year. If these arrears, which amounted to 699*l.*, had not to be met they would have had sufficient to have paid nearly 1 per cent to the improved debenture-holders, and they trusted that next year they would receive a dividend. Their property was in a better condition than it was in before; a new pumping engine had been put down at a cost of 500*l.*, and a building erected at the wharf for the accommodation of the boatmen and their horses. On the whole, he thought the company had done very well; but he trusted that next year their balance-sheet would be much better.—Mr. S. Lloyd seconded the motion, and the accounts and report were adopted.—The meeting was then made special to consider the following resolutions:—"That the deed, the draft of which is produced to this meeting, and is identified by the signature of the Chairman written at the foot thereof (being a deed of arrangement for the surrender of the existing leases of mines of the company at Essington, in the county of Stafford, in exchange for one new lease of the same premises), be and the same is hereby sanctioned and approved, and that the directors of this company and the debenture trustees are hereby authorised and requested to execute and carry out the same."—After a short discussion it was resolved on the motion of Mr. Neale, seconded by Mr. Gallimore, that a committee be appointed to investigate the question of the proposed new lease, and report to the meeting, which was to be adjourned for fourteen days.—The meeting then terminated.

COPPER AND NICKEL ORES AND SCORIA.

Some improvements in treating ores or scoria containing copper or nickel, and in the apparatus to be used in the process have been invented by Mr. EUGENE HERMITE, of Rouen, and are said to have been successful in practice. The ores or scoria are first subjected, in the condition of fine powder, to the action of a solution of ammonia in the presence of compressed air, and subsequently subjecting the resulting liquid holding the metals in solution to electrolysis, preferably in apparatus constructed and arranged as hereinafter described. The ores or scoria containing the copper or nickel which it is desired to extract are first reduced to a fine powder and then placed in a vessel preferably so constructed as to be capable of rotating for the purpose of turning over its contents. A solution of ammonia is also introduced into the vessel, the proportion of ammonia in the said solution being regulated according to the richness in metal of the ore or scoria, and the air in the vessel is then compressed to a pressure of from about three to four atmospheres. The vessel is then rotated for a length of time in accordance with the nature of the materials under treatment; from about 30 to 60 minutes will, he believes, be found to be the usual time required. After settling, the liquid holding the metal in solution is decanted; the ore is then washed again with a fresh supply of ammonia solution if required, and finally with water, but always under pressure. The liquid or solution obtained as aforesaid is afterwards subjected to electrolysis in vessels containing plates or electrodes of cast-iron and carbon, the whole of the metal in the solution being collected on the cast-iron electrodes—a small quantity of caustic soda or potash may be added to the liquid in order to render it a better conductor. If preferred the apparatus employed for the purposes of this invention may be made entirely of iron, as ammoniates of copper or nickel are not decomposed by this metal.

The operation of electrolysis is preferably performed in apparatus specially constructed and arranged, which is provided with a series of vessels in which the process of electrolysis is conducted. These vessels are preferably constructed of sheet-iron with sealed or luted lids or covers having hydraulic joints and contain cast-iron plates or electrodes arranged alternately with carbon plates or electrodes, each set of electrodes being connected to suitable conductors. The vessels communicate at the lower part through pipes or passages and valves with an outlet tube or passage for removing the separated metal that falls to the bottom of the vessels and the liquid. The liquid may be supplied to the vessels from a tank or reservoir provided with a distribution pipe and delivery cocks. A travelling crane is preferably employed for lifting the covers and the electrodes and valves. The conductors are connected together by sleeves or unions, and are insulated from the sides of the vessels by insulators of porcelain or other suitable material. The vessels are charged with a liquid or solution obtained by treating ores as described, and the covers being secured in position a current of electricity is caused to pass through the solution. The metal is thereby separated from the solution and deposited on iron plates. When the operation is concluded the metal is collected from off the plates or electrodes, and the liquid is drained off by opening the valves. The metal thus obtained may be melted and run into ingots, and the liquid may be used again if desired for treating a fresh supply of ore. Thus the essence of the invention is the treating ores or scoria containing copper or nickel with a solution of ammonia in the presence of compressed air and by electrolysis, and as a step in the treatment subjecting the same to the action of a solution of ammonia in the presence of compressed air.

SEPARATING LEAD FROM PRECIOUS METALS.

In the ordinary process of leaching separating metals from ores by chemical solutions the compounds of silver and gold are extracted by being dissolved out with a solution of a hyposulphite of an alkali or alkali earth, in which these compounds are soluble. The sulphate and chloride of lead, however, are often also present in the ores, and are likewise soluble in the hyposulphite solution. These lead compounds being dissolved out of the ore or product along with the precious metals contaminate the bullion which is produced. Owing to their presence in the bullion the subsequent refining of that bullion becomes an expensive process, and the leaching process has, therefore, been disadvantageous in the case of certain kinds of ores. By the process invented by Mr. E. H. RUSSELL, of Park City, Utah, this objectionable feature of the leaching method of treating ores is removed, and the separation of the lead from the precious metals is secured. In the leaching process heretofore in use the hyposulphite solution, after it has passed through the mass of ore and has dissolved out both the precious metals and lead compounds, is conducted into precipitating tanks, and both the precious and base metals are precipitated therefrom together usually as sulphides by means of sodium or calcium sulphide. In the carrying out of the improved process the solution after leaving the ore is conducted into suitable precipitating tanks, and a soluble carbonate is introduced into or added to the solution in a sufficient quantity to convert all the lead compound into carbonate of lead which is insoluble in the hyposulphite solution, and sinks to the bottom. It is best to add a slight excess of carbonate.

The soluble carbonate may be a carbonate or bicarbonate of either sodium or potassium, but as a cheap article is very desirable he prefers to use soda ash, an impure but inexpensive carbonate of soda. He does not, however, limit himself to the use of soda ash. The compounds of the precious metals also contained in the solution after use upon the ore or product are not precipitated with the lead by the carbonate. After the precipitation of the lead the solution containing the precious metals is conducted into tanks, and these metals are then precipitated by the common and well-known method usually as sulphides. As a result of the use of the process the bullion produced from these sulphides contains no lead, but the lead is obtained by itself in such a form that it is of considerable value. This process then is far more economical for use in treating certain ores than processes now in use. He finds that copper, if present in the solution, will not be precipated with the lead, but remains in the solution with the precious metals.

The action of the soluble carbonate when added to the hyposulphite solution containing the precious metals and lead together is peculiar. When added to aqueous solutions of the compounds of these metals, as has heretofore been done, it precipitates lead and precious metals all together. But he has discovered that when added to the hyposulphite solution after leaching therewith, the carbonate precipitates the lead alone, and leaves the silver, gold, and copper that are present in the solution unprecipitated. This peculiar action of the carbonate, when added to a hyposulphite solution containing precious and base metals together, has, he believes, never heretofore been known or made use of in quantitative or qualitative analysis in the laboratory, nor is it to be found set forth or described in any work on chemistry or the treatment of ores or metallurgical products. Mr. Russell's process is intended to be used particularly upon ores or products which have been previously subjected to a chlorodising roast, but is also applicable to some raw ores in which the precious metals exist in forms which are soluble in the hyposulphite solution and to ores which have been exposed to chlorine gas or to an oxydising roast.

It is obvious that instead of leaching the ores or products with the hyposulphite solution they can be subjected to the solvent action of the solution by any other of the ways well known to those familiar with the art without departing from the spirit of the invention. The process is more particularly applicable to ores that have been subjected to an oxydising roast, thus avoiding the use of 5 per cent. to 20 per cent. of salt which is required in the chloridising roasting. This is a very important point. It will be seen that the essence of the invention consists in preparing a hyposulphite solution of the metals and treating it with a soluble carbonate.

ELECTRIC SAFETY-LAMPS.

In electric safety-lamps as hitherto constructed for use in mines if the globe enclosing the filament be broken the filament will generally retain sufficient heat to ignite carburetted hydrogen, and consequently explosion may ensue. It has been proposed to enclose an incandescent lamp within a glass casing or lantern filled with water, but in this arrangement if the glass casing be broken the water will escape and the lamp is then practically unprotected, and, therefore, dangerous. It has also been proposed to fill the outside casing with water impregnated with carbonic acid gas under pressure for operating a flexible disc (or equivalent means), to which is attached a contact piece in such a manner that a pressure within the casing will caues contact to be made so as to establish the electric circuit. In this arrangement if the casing be broken the gas and liquid contained therein will escape, the interior pressure will be removed and the circuit will be immediately broken and the lamp extinguished. In practice, however, it has been found that the breaking of the circuit in the manner described produces a sparking which would ignite explosive gases, so that such lamps have not been practicable.

The improvements proposed by Mr. T. COAD, of Finsbury, consist principally in preventing such sparking by constructing the contact pieces of sufficient length, and in placing over such contact pieces a covering of suitable material, such as india-rubber or the like, which will closely embrace the parts so as to effectually exclude all dangerous gas from coming into contact with the sparks produced on the breaking of the electric current. And further in order to prevent the sparking which might be produced by metallic contact whether accidental or otherwise, he dispenses with the use of terminals by carrying the conducting lines direct from the lamp into the battery, so that when the lamp is fixed thereto the wires will be entirely enclosed and protected. In order to prevent the escape of the carbonic acid gas employed to produce the pressure within the glass casing he employs a flanged disc and a flanged ring. The outer glass casing consists of a flanged dome, the bottom of the flange of the dome resting against the upper face of the disc and the top of the flange bearing against the underside of the flanged ring. The disc and ring are clamped together by bolts and nuts, so as to allow of securing by means of suitable packing a tight joint between the glass and the ring and disc, thereby effectually preventing the escape of the compressed gas.

The battery and its receptacle, the lamp, the flexible disc, and the spring for breaking contact if the lamp be broken are all of known construction. There are contact pieces to receive a covering of suitable material, such as india-rubber or the like, which will closely embrace the contact pieces; the lower contact piece is provided with a lock nut for adjusting its position with regard to the upper contact piece; there are the usual conducting wires which he carries direct from the lamp into the battery, where they are connected direct to the poles of the battery instead of to the terminals usually fixed thereto; the wires when the lamp is fixed thereto will be thereby entirely enclosed and protected. There is a flanged disc and a flanged ring for fixing the outer glass over the lamp, the glass being filled with water impregnated with carbonic acid gas as heretofore; the outer glass is flanged, the bottom of the flange resting against the upper face of a flanged disc, and the top of the flange bearing against the underside of the flanged ring: there are bolts and nuts for clamping the disc and ring together, and the packing for securing a tight joint between the glass and the ring and disc. In a lamp of this construction, if the interior pressure be removed from the flexible disc by the casing or glass becoming broken, the disc will be forced upwards by a spring, which will also carry up the contact piece, and contact will be thereby broken between the two contact pieces: the sparking produced by the breaking of the circuit in this manner will be prevented from igniting the explosive gases, as such gases will be effectually excluded by the covering over the contact pieces. Further any sparking which might otherwise occur is obviated by dispensing with the use of terminals, and carrying the conducting wires direct to the battery. By employing the flanged disc and ring and flanged outer glass connected together as described, the escape of the carbonic acid gas employed to produce the pressure within the glass casing is effectually prevented.

The novelties claimed are:—1. In miners' incandescent electric safety-lamps the described method of preventing the effects of sparking in the event of the breakage of the electric circuit by enclosing the contact pieces with a covering of suitable material.—2. The method of preventing sparking in miners' incandescent electric safety-lamps by carrying the conducting direct from the lamp into the battery, whereby they will be enclosed and protected; and—3. The described means for producing a tight joint to prevent the escape from the outer glass casing of the compressed gas employed to operate the flexible disc.

TREATING METALLIC SULPHIDES AND OXIDES.

An improved and more economic method of treating sulphides and oxides of metals and obtaining products therefrom has been invented by Sir F. C. KNOWLES, of Lovell Hill, Bart., and in describing his improvements, he states that, before submitting the minerals or other substances to this treatment, they must be carefully freed from silica and earthy matters, above all from silica, and that in the case of sulphides he places the substance in a closed retort similar to those used in gasworks, but furnished with pipes for the admission of a current of air heated by preference, and for the exit of the products of calcination being sulphur, arsenic, or both. These are to be collected in appropriate vessels or receivers, the arsenic as vapour in cooling chambers as ordinarily, the sulphurous acid gas as may be most preferred, for sulphuric acid or for chemical combination with some other substance as the base. The process of calcination is to be continued until the substance is roasted "dead" as it is termed or a perfect oxide is obtained, he prefers using in this stage a rotating retort or some mechanism whereby a fresh surface of the sulphide may be continually exposed to the heated air. In the case of sulphide of lead containing antimony, the oxide produced must be heated apart, and the sublimed oxide of antimony collected in suitable coolers.

The required oxide or oxides having been thus obtained they are to be transferred to other retorts revolving by preference, and a current of coal gas, peat gas, or vapour of petroleum free as can be from sulphur is to be passed at a good red heat over, and through the oxides, tin, copper, lead, and iron or they alone are mixed until they are all save the iron reduced to the metallic state. The mixture is then to be transferred to a reverberatory or other melting furnace in which a neutral flame is produced, whether from coals, from petroleum vapour, or from the combustion of gas supplied by a generator. The heat must be carefully regulated according to the nature of the metallic combination. The tin will come away at 442° Fahr., the lead at about 312° Fahr., the copper at 1996° Fahr., including gold 2016° Fahr., and silver 1873° Fahr. if present. The iron in the state of protoxide or reduced, remains. By this method of liquation, the metals can be separately collected as they flow off in succession, the heat being so regulated that it shall be nearly as practicable adjusted in succession to the respective fusibility of the metals. The iron oxide, even if reduced, will be infusible at the heat required to separate all the other metals, and will remain as a pure iron ore, or reduced iron. If before this fusion of the metals the presence of any residue of silica, &c., be suspected a little soda thrown in will run it into a glass at the highest temperature and prevent its forming a silicate.

FOREIGN MINING AND METALLURGY.

Prices have scarcely varied in the French Iron Trade. In connection with a recent adjudication for steel rails required for the Western of France Railway there was a rather severe competition on the part of the Denain, Iœuf, and St. Nazaire Companies. The terms offered by the Denain Company were about 8s. per ton lower than those named in the tender of the St. Nazaire Company, being 4*l.* 8s. and 4*l.* 16s. per ton respectively at the works. It is argued that such terms as these will merely involve the firms submitting tenders in a loss. The Western of France Railway Company has given an order for 2400 axles to the Commentry Works, The terms upon which this order has been given are stated to be relatively remunerative. Prices have not varied in the German iron trade, the general situation remaining practically unaltered. Pig was exported from Germany in the first 10 months of last year to the extent of 185,252 tons. The exports of iron from Germany in the same period were 132,691 tons; those of rails 118,939 tons, and those of wire were 176,168 tons. Axles and tyres were also exported from Germany in the first ten months of last year to the extent of 8990 tons. Pig was imported into Germany in the first 10 months of last year to the extent of 225,413 tons; iron to the extent of 13,699 tons, rails to the extent of 544 tons, wire to the extent of 2617 tons, and axles and tyres to the extent of 348 tons. The imports of lignites into Germany in October were 363,136 tons, and in the first 10 months of last year 2,858,169 tons.

There has been no change of importance in the Belgian Iron Trade, at any rate so far as prices are concerned. If anything, the general aspect of affairs appears to have become slightly better during the last few years. Out of 31 blast-furnaces in the Charleroi basin 15 are now in operation, and are producing a little less than 40,000 tons of refining pig per month. The stock on hand is estimated at 65,000 tons, or about a month and a half's production. Out of 508 puddling-furnaces in the Charleroi basin 377 are now at work, and their monthly consumption may be estimated at a little more than 40,000 tons. It may, then, be assumed that the current consumption of pig in the Charleroi district is about equal to the production, and that the stock is even being reduced to some extent. It is reported that discord prevails in the International Steel Rail Syndicate. The English members of the syndicate contend that the British colonial market especially belongs to them. The German members of the syndicate altogether dispute this pretension, which should have been settled one way or the other before the syndicate was formed. English casting pig has continued to be quoted at 2*l.* 2s. 6d. per ton in Belgium. Refining pig, hard iron, has made 1*l.* 17s. 6d. to 2*l.* per ton; ordinary pig, 1*l.* 15s. 2d. to 1*l.* 16s. per ton; and mixed pig, 1*l.* 12s. to 1*l.* 12s. 10d. per ton. Iron has contiuned to be quoted at 4*l.* 8s. to 4*l.* 10s. per ton for exportation, and at 4*l.* 10s. to 4*l.* 12s. per ton on home account. No. 2 has remained at 4*l.* 16s. per ton, while No. 3 has made 5*l.* 2s. per ton. Girders have been rather firmer.

The Belgian Coal Trade has maintained a generally firm tone. This has been due, to some extent, to the fact that the weather has become colder in Belgium, while a certain quantity of snow has fallen. Prices have experienced no material change. Coke has been, if anything, a little firmer; the current rate in the Hainaut has been about 10s. per ton. The number of trucks carrying coal and coke which passed over the Belgian State Railways in the week ending Dec. 21 was 19,181, as compared with 21,767 in the corresponding week of 1883, showing a decrease of 2586. The German coal trade has reflected a certain amount of hesitation. A spell of really cold weather would probably bring with it some advance in quotations. On the other hand, if the weather should continue comparatively mild, a fall in prices would probably be witnessed. The deliveries of coal on the railways accommodating the basin of the Ruhr appear to be about stationary. The movement in December was, however, larger than the corresponding movement in December, 1883. The imports of coal into Germany in the first ten months of last year amounted to 1,869,320 tons, as compared with 1,828,312 tons in the corresponding period of 1883, showing an increase of 41,008 tons last year. Of the 1,869,320 tons of coal imported into Germany in the first ten months of last year, 1,223,730 tons came from Great Britain. The exports of coal from Germany in the first ten months of last year were 7,120,056 tons, as compared with 7,063,126 tons in the corresponding period of 1883, showing an increase of 56,930 tons last year

SPEED TRIALS OF VESSELS.—At the meeting of the Institution of Engineers and Shipbuilders in Scotland, held in Glasgow on Dec. 23, Prof. James Thompson in the chair, Mr. William Denny read a paper "On Mr. Mansel's and the late Mr. Froude's Methods of Analysing the Results of Progressive Speed Trials." The author concluded a somewhat long paper, which was a reply to a pamphlet issued by Mr. Mansel, by saying that—"If we look to the future it is evident there lie before us the possibilities of very extraordinary performances in speed. Both for purposes of war and for purposes of quick passenger traffic speeds are now being required and thought of which a few years ago would have been deemed impossible and absurd. Besides, it is to be remarked that great hopes have been raised in the popular mind by the performances of the small-sized torpedo boats, and it is not easy to make the ordinary public understand what a very wide interval divides the performances of the torpedo boats from even the fastest performances which have been lately attained by Atlantic steamers. Those who know the realities and the difficulties of the speed and power question are aware that in the torpedo boats there is a development of power sufficient to carry them in many cases into the region beyond the humps of their resistance curves. And they know that in no case has this region of the resistance curve ever been approached by any of the fast, full-sized steamers. We are not likely to see torpedo boat performances on a large scale, but, short of this, there may soon be very wonderful speeds attained at sea, and far beyond those attained at the present moment. Looking to all these possibilities, it seems an absolute necessity that our ideas upon speed and power and the resistance question should be large and catholic, and not cramped by insufficient and empirical formulæ. There is an immense deal in these questions still awaiting solution, and I have not found it possible in this paper to do more than touch in a general way upon some of the most important points This may stimulate the minds of those interested in the subject to further investigations and study on their own account.

SILVER IN NEW SOUTH WALES.—Fresh discoveries of silver are continually being made in various parts of the colony, several being of great richness, and there is every prospect of New South Wales taking a leading place among the great silver-producing countries of the world.

NEW SOUTH WALES SILVER.—The quantity of silver ore raised at the lately discovered mines at Silverton, to the end of September, 1884, was 5115 tons, valued at 116,590*l.* Another estimate considerably exceeds this.

Her Majesty the Queen has been graciously pleased to present to the funds of the Bookrellers' Provident Institution, through Sir Henry Ponsonby, K.C.B., a donation of 20*l.* Her Majesty has been the patron of the society since the year 1868.

THE FUTURE OF THE COPPER TRADE—No. II.

At the capitulation of Montreal, in November, 1760, Detroit, Mackinaw, and all other places and territory then in possession of the French, were surrendered to the English Crown; thus in 1760 ended the French power in Michigan. The change altered little the condition of the residents. The Indians looked on the English with distrust, and at the instance of Pontiac, an Ottawa chief, several tribes banded together to exterminate the British. Hostilities broke out in May, 1763, and raged throughout the entire region of the great lakes, all the forts in Michigan save Detroit being taken. After a siege of 12 months a force of 3000 troops arrived to the help of Detroit, when the Indians sued for peace and a treaty was concluded. After the close of this war the English sought to conciliate the Indians and French and win them over to their interests. More liberality was exercised in the matter of granting lands; some settlements began to be made, and a better system of laws was introduced.

In the early annals of the country, mention is made of failure to find gold and silver as was expected. Abundance of copper was picked up on the shores of Lake Superior, and even the big mass lying on the bank of the Ontonagon river was seen and described in 1721 and 1765. An Englishman named Henry made an abortive attempt at mining near this mass, hoping to find gold and silver. A piece of ore weighing 8 lbs. containing considerable silver, was found upon the shore of Lake Huron, and sent home to the British Museum. This mining adventure was stopped owing to the breaking out of hostilities between England and her American colonies. The peace which followed this long war in 1783, left Michigan within the borders of the new nation, and was claimed by several of the Eastern States as Crown lands; these claims were, however, relinquished in favour of the United States. The Indians resisted settlement in Michigan, and the actual and unobstructed possession of the company was not obtained until 1796. In 1798 Michigan sent one delegate to the Convention of the North-Western Territory, this being the first officer elected under the United States Government. Disturbances again broke out with the Indians in 1811 and with the British, and after much bloodshed and cruel treatment peace was once more proclaimed in 1815, and Michigan thenceforth relieved from British power. General Cass was appointed governor, and he directed himself to re-building the towns and forts which were in a wretched condition owing to the wars. The population in 1820 numbered 8896; Detroit contained 250 houses, Mackinaw 150 houses. In 1819 the first steamer launched on the lakes made her way up to Mackinaw.

Accompanied by a select party, Gen. Cass started, in 1820, on an exploratory expedition, it being one of the chief projects to make, as far as possible, geological and mineral investigations. A thorough survey was made, and the land divided into townships of 6 square miles each, these being again surveyed out into sections of 1 square mile each. The lower peninsula is a drift formation, in which rocks of every variety are found, but seldom *in situ*. The out-cropping rocks are sandstones, carbonates, and sulphate of lime. Underlying this sandstone is a limestone which is frequently silicious, but in some places makes excellent quicklime. Other sandstones of better quality, underlying the former, occur at various points in Lower Michigan. Associated with these is the coal, which is mined in Jackson and Shiawassee counties from coal seams having a thickness of from 3 to 4 ft. Gypsum is also found, but the chief mineral product of the lower peninsula is salt. The existence of the salt springs was known to the Indians long prior to the advent of the white men. The State now surpasses in the production of this article any in the Union. In 1859 the first company was started for its manufacture. Two modes are practised of obtaining it—by artificial evaporation and by solar evaporation. The business has swollen from the manufacture, in 1860, of 4000, to 3,037,317 barrels in 1882; and the total number of barrels made in the State during the 22 years is 24,652,985. In quality it is not surpassed by any. Dr. Houghton published the results of his observations, in 1838, on Lower Michigan, from which it appears that he had determined the existence of native copper in the rocks of that country. Knowing that the country must be surveyed before the land could be purchased, Dr. Houghton devised the plan of uniting geological observations with linear surveys, and succeeded in getting the Government to adopt it. In 1843 numerous applications were made to the War Department, by individuals for permits to explore for minerals, which were granted on the condition that the full description of the claim selected should be sent in within one year. The party was then entitled to a three years' lease a royalty to be paid on the ore raised, which lease might be renewed for another three years. These grants were suspended in 1846, Congress declaring that the issue of them was without the authority of law. In 1847 the Lake Superior land district was established. The land office was located at the Sault de Ste. Marie, and for a time there was much hurrying by rival claimants in their endeavours to forestall each other in securing coveted lands.

Subsequently the mineral lands were appraised by Government agents at $5 per acre. The first locations were made at Copper Harbour. In 1848 the villages in the copper region were Copper Harbour, Eagle Harbour, and Eagle River, Mackinac, and Ste. Marie. The first general mining law of the State was made in 1853; previous to that time the companies worked under special charters, or as partnership concerns, or were incorporated under the laws of other States. With regard to copper, up to the discovery of the Minesota Mine, very little success had attended the efforts which had been, made in this country. Soon after the discovery of the Minesota Mine, the National Mine began its prosperous career, and stimulated by this many others sprang into existence. With the wane of these two mines the fortunes of the county of Ontonagon were obscured. The Keweenaw county, once the leading copper district, has been like Ontonagon, some years at a standstill. The active mines in the county at the present time are the Conglomerate, Central, Copper Falls, Cliff, St. Clair, Phœnix, and Allonez. During the early days of mining in the Lake Superior country the region about Portage Lake received but little attention. Mining work first began here in 1852 at the Isle Royal Mine, and subsequent developments have raised the district to the leading one for copper mining in the world. The active mines are the Wolverine, Centennial, Calumet, Hecla, Osceola, Peninsula, Franklin, Pewabic, Quincy, and Hancock on the north side; and the Grand Portage, Isle Royal, Huron, and Atlantic on the south side. These mines have developed an unparalleled richness. Smelting works are in operation at Hancock. The Mineral Range Railroad connects Hancock with Calumet, passing on the way Peninsula and Osceola mines. The discovery of iron ore was made by a party of Government surveyors in 1844, and the first location of iron lands was made in the summer of 1845. A company was formed and a forge erected on the Carp River. The difficulties of production were too many and serious for the maintenance of the concession, and it was abandoned in 1856.

The iron business on Lake Superior had developed but little, and was far from prosperous prior to 1860, after which the great demand occasioned by the exigencies of war caused the iron interests in this region to assume for the first time a successful aspect. Possession was first taken of the Cleveland location in 1846, and after some protracted disputes as to claim it was settled in favour of the Cleveland Company, but no work was done until 1853. The Marquette Company, one of the rival claimants for this property, had erected a forge for the manufacture of blooms, which was subsequently worked by the Cleveland Company, but the manufacture of blooms at all the forges ever started in this district proved financially unprofitable. The Lake Superior Mine was also involved in controversy regarding ownership, but was ultimately sold to the Lake Superior Iron Company in 1853. The Jackson, Cleveland, and Lake Superior Mines, the oldest in the district, still continue to be among the most important. The construction of a railroad from the mines to the harbour at Marquette, and a canal round the Sault de Ste. Marie, played an important part in the development of the industry. The canal has been enlarged and was finally completed and opened in 1881. The railroad has been completed so as to afford communication with Chicago, which, as may be inferred, has effected great changes in the district. A line of rails has also been laid down between Champion to L'Ause, at the head of Keweenaw Bay. There are several short lines in the copper district, all of which, except the Mineral Range Railroad between Hancock and Calumet, are owned by mining companies. For many years railway extensions to Houghton and Ontonagon have been contemplated, and a line is in process of construction from the harbour of Ontonagan to the Wisconsin State line, where it will join a line from Milwaukee. A railroad from Marquette to the Straits of Mackinaw has just been completed.

The Chicago and North-Western Company has shown much enterprise and liberality in extending and operating its lines in Michigan, branches having been extended into various regions not only rich in minerals but also in agricultural products. The Menominee iron range affords a remarkable instance of rapid development. The first iron ore, amounting to about 10,000 tons, was shipped in 1877, which in six years increased to a yearly shipment of 1,000,000 tons. This success is due in no small degree to the railroad, and the readiness with which the North-Western has extended branches to newly-discovered iron mines. The upper peninsula is a region of great prosperity, and still greater possibilities; its mining resources are permanent, and for the future must be added thereto a diversity of other interests. Minerals, however, must ever be considered the basis of the prosperity of this region; its copper and iron are phenomenally rich and pure, and the deposits extensive, and from no other region can those minerals with less difficulty or greater economy be mined and transported to the markets of the world.

ELECTRIC LIGHTING, AND GOVERNMENT RESTRICTIONS.

Although in the case of electric lighting, as proved by the test of experience to date, their failure commercially has been as complete as that of the Indian gold mines, yet if the recommendations of Lord Bury's Committee be adopted the people are to be more heavily taxed to pay for the appointment of Government Inspectors to prevent the electricians doing personal injury to the public, whilst the companies would have the power to use the public streets, and to supply light, or refuse to supply it, to suit their own pockets. It is unlikely that such obviously unjust set of recommendations would be santioned by the most Tory House of Commons ever elected, but it is essential that those who desire to see the peoples' rights respected and increased, and unnecessary taxation prevented, should at once bestir themselves, lest the proposed alterations be surreptitiously procured. It may be said that the present temporary success of one of the Indian gold mines would justify the hope of better things in the future of Electric Lighting Companies, but it must not be forgotten that it is now confidently stated that the gold mine in question is merely working out the end of a constantly diminishing deposit left by the natives, and that in the course of a few months at most there must be a repetition of the great Emma collapse. Lord Bury's Committee have considered, not only the Act of 1882, but also the provisional order adopted by the Board of Trade in 1883, and the only license yet granted by the Board —that to Colchester. The Committee have agreed to resolutions:—1. That the Act of 1882 may be made workable by the omission or alteration of two or three clauses.—2. That the form of provisional order adopted by the Board of Trade is unduly severe, and requires amendment in two principal, and a few minor points.—3. That the form of license adopted by the Board of Trade proceeds on an erroneous interpretation of the third clause of the Act, and should be remodelled.

The main objection felt by the committee to the Act (says the Times) lies in section 27. This section, commonly known as "the purchase clause," provides that at the expiration of 21 years from the granting of the Provisional Order, and at the expiration of each period of seven years subsequent to that time, the local authority within whose district the undertaking lies may require the undertakers to sell to it the undertaking at a price fixed solely by the then value of the plant, material, and buildings taken over. Inasmuch as the Electric Lighting Act, 1882, governs all Provisional Orders and licenses granted under its provisions, this is a condition to which all undertakings for electric lighting must necessarily be subject so long as the Act is in force in its present form. This clause renders it impossible to place undertakings for electric lighting on a sound commercial basis, and is, indeed, prohibitory. The only chance for the electric light is, that it shall be able to compete in the matter of cheapness with gas. If, therefore, the relative conditions under which the two illuminants are supplied are unduly severe on the electric light, this circumstance must, by affecting their respective prices, materially affect the demand for the electric light. At present the legislative conditions are incomparably more favourable to gas, which can undersell its rival. The gas companies hold their powers in perpetuity; they can afford a present loss or content themselves with diminished profits for a time in order to get rid of a troublesome competitor. But the 27th section of the Electric Lighting Act of 1882 limits the tenure to 21 years, except where the undertaking is a commercial failure. An electric lighting undertaking, while thus competing with gas at a reduced figure, would be compelled, owing to its short tenure of its property, to charge from the first such a price as would show sufficient profits to pay immediate dividends, and to leave a surplus each year sufficient to form a large reserve fund. This would be necessary in order to replace the loss of capital contemplated by the purchase clause. The terms of the Act render it evident that the price at which the local authority is entitled to take the works must necessarily represent only a small portion of the capital expended on them, and the loss which would thus have to be provided against would be specially great in the case of the earlier undertakings, by reason of the novelty of the enterprise and the lack of experience. If the undertaking is to keep abreast with the advance of electrical science, large sums would have also to be expended in the improvement, or perhaps the replacement, of earlier forms of plant. If an undertaking is, under these circumstances, to make a fair commercial return to the undertakers within 21 years, the net profits must be very high during the whole or a large portion of that time. The price at which electricity is supplied to the consumer must therefore be out of all comparison with its fair cost under sound commercial conditions of production. This enhanced price would prevent any large demand springing up, and would thus ensure the failure of the enterprise. The committee, after dealing with the financial aspect of the question, express the opinion that if electric lighting is to exist as a public institution in England it is absolutely necessary that the term of 21 years must be extended, unless Parliament desires to maintain the monopoly of the gas companies, and make electric lighting impossible. The committee indeed recommend that the powers granted to electric light undertakers should be, as in the case of gas companies, in perpetuity, and that the 27th section should be wholly repealed. If the principle that local authorities should have the power to acquire such undertakings is to be upheld, then the term should be increased, and the price paid should be a fair value.

Objection is also taken by the committee to Clause 16, by which the undertakers are deprived of all power of controlling the use to which electricity is to be put by the consumer. The supply must be by meter. At the present time there is no warranted meter; therefore, the undertakers ought to be allowed to charge by the light supplied, and no lamp ought to be used by the consumer save what has been approved by the undertakers. This provision would be the same as has been made in the case of gas. It is well known that when first introduced gas was for many years supplied without meter; and in the Gasworks Clauses Act (passed as late as 1847) there is a provision that, in case gas is supplied otherwise than by meter, no consumer shall use any burner other than such as has been approved or provided by the undertakers. In incorporating the provisions of this Act into the Electric Lighting Act (section 12, sub-section 2), this equitable and beneficial provision has been specially excepted, and the committee are of opinion that this exception should not be made, and that the undertakers should be permitted to charge the public by the service actually rendered as measured by the light provided, and that if the undertakers elect so to do, and not to charge by meter, they should be entitled to prescribe the kind of lamp that is to be used. The committee also recommend that where the local authorities are themselves holders of Provisional Orders they should not have an absolute veto on application for licenses in their district.

The provisional order adopted by the Board of Trade should, in the opinion of the committee, be amended in two fundamental points—1, the provisions with regard to the compulsory laying down of mains should be omitted, and the undertakers should be allowed to determine for themselves what mains are to be laid down; 2, the power to require a supply should be limited to consumers who are prepared to take the supply contracted for during 1000 hours, at least, in the year. The committee, further, are of opinion that all inspection of electric lines and works should be in the hands of skilled inspectors appointed by the Board of Trade, and not by the local authority.

With regard to the form of license adopted by the Board of Trade, the committee are of opinion that the board have proceeded on an erroneous interpretation of section 3 of the Act of 1882. They recommend that the form of license should be so far remodelled that the holders of licenses should be permitted, with the consent of the local authority, to use streets for the purpose of such private or limited supply as they may undertake to give without being required to give any other or public supply.

MINING PROGRESS IN CANADA.

Mining operations in Canada have been for some time past somewhat crippled for want of capital; and, considering the vast mineral resources of that country, it is a matter of surprise that more investors have not come forward to aid in developing its mines. Possibly, however, the general depression in trade has had something to do with it, and it is to be hoped that with a revival in trade generally the mineral wealth of Canada will claim more attention. The Canadians themselves feel that the surest way to encourage capital into the country is by guiding it at the outset into channels, where it will be certain to find profitable investment. The Canadian Mining Review states, with regard to the phosphate industry, that the total quantity shipped from Canada during the season of navigation of 1884 to foreign ports was 21,243 gross tons, an increase of 3403 tons over the previous year. This was somewhat below what it would have been had not the road from the Buckingham district become impassable, owing to the unprecedented continuance of wet weather. The serious impediment caused by the bad condition in which this road from Buckingham village to the railway depot has been allowed to remain in is now removed. After a long and determined struggle the phosphate miners have succeeded in inducing the Canadian Pacific Railway Company to construct a short branch road from the landing on the Du Lievre River, north of Buckingham village to connect with the main line at Buckingham station. Henceforth the transportation of phosphate will be made easy as compared with former years. Some parties in Ottawa have acquired the Red Granite property on the east side of the harbour at Kingston, who are about to work it on an extensive scale. The granite is sound, uniform, and of a rich flesh or salmon colour, and the position of the property offers unusual facilities for working the quarry, and obtaining a reliable supply of labour for dressing the stone. In the Lake Catacha district the Oxford Gold Mine has had a very successful year; $30,000 have been paid as dividends, besides a large sum which has been expended in plant and machinery. The improvements in plant have been extensive; new hoisting and pumping machinery has been erected, a tramway from the workings to the mill has been constructed, and an additional engine and boiler supplied. A road has also been laid down from the mine to Chezzetcook Harbour, supplying a much needed want of good and direct transportation. A steam drill is being used in driving on the lode, which will make a great saving in the cost of mining. In Marmora the Gatling or Consolidated Mine is being worked with a force of 35 men. It is reported that the difficulties in the way of extracting the gold from the obstinate arsenical ore of this mine are overcome, and with the stock of ore on hand and the large quantity in sight there is a good prospect for the future. Mica mining is likely to become an industry of much importance, owing to the many valuable discoveries of extensive deposits in various localities in Ontario and Quebec, and to the rapidly increasing demand for the mineral by stove manufacturers, and for other purposes.

Among the Lake Superior mines considerable activity is reported at the Rabbit Mountain Mine. The new find at Silver Mountain is attracting a good deal of attention. The Twin City Mine is to be opened again. The silver ore taken from the mine is as fine as from any in the district, and the prospects of the company are most encouraging. The Beaver Mine, which is also highly spoken of, is about to be opened. Important developments have taken place in the iron ore deposits of Central Ontario. The Orton Mine, in the Tudor township, probably presents the largest showing of any of the properties now being developed. There is a very large extent of surface exposure, but the first specimens mined showed 7 per cent. of titanium, otherwise the ore was found to be very pure. At the Emily Mine 6 miles north, a large surface opening has been made, though no definite results have been arrived at as yet. At the Baker Mine a number of test-pits have been sunk, showing a formation about ¾ of a mile in length, and in shape like a horse-shoe. The mine will in all probability be developed on an extensive scale next season. The Chandos Mine will also be vigorously worked next season. Extensive developments have taken place at the Coe Hill Mine, and evidences of hard work and liberal expenditure are to be seen on every hand. Much work has been done in stripping and in sinking test-pits, all of which show that the course of the vein is almost due east and with an ascertained length of 1300. The course of the vein, even from the surface, is quite distinct beyond shaft No. 3. In digging for the foundations of the engine-house, a parallel vein was unexpectedly struck, compelling a change in location. An examination of these two veins would appear to carry out the idea of the proprietors that the rock is pinched out and that the two veins come together below. Opinions vary, however, as to whether their surmises are likely to prove correct.

RAILWAY PROGRESS IN NEW SOUTH WALES.—Nowhere in the whole of the British Empire are the advantages of railways better understood than in New South Wales, where the policy of the Government in obtaining loans for railway purposes is heartily approved, the only grounds of dissension being in connection with the choice of lines to be first proceeded with. It is 29 years since the opening of the first railway in Australia. On Sept. 26, 1855, the railway line from Sydney to Parramatta was opened for traffic, and since that time railway construction has proceeded until there are now over 1600 miles of railways in use, about 300 in course of construction, and proposed extensions representing over 1400 miles under the consideration of Parliament. The total capital expenditure on railways opened and in course of construction at the end of last year was 19,188,464*l*., of which there was expended in 1883 2,411,822*l*. The gross earnings from all sources last year were 1,931,464*l*., being an increase over the amount for 1882 of 232,602*l*., a sum which would have been 100,000*l*., more but for a reduction which was made in railway rates. The working expenditure amounted to 1,177,788*l*. The mileage run was 1,086,134 miles in excess of the number for 1882. If the rates for 1883 had been maintained at what they were in 1882 the revenue from the railways would have been 2,079,278*l*.; and but for an increase of wages, the expenditure would have been 34,300*l*. less. There were added to the rolling stock during the year 28 locomotives, and 275 passenger and 797 goods vehicles. Within the last two years this colony has been particularly busy in the matter of railway extension, and the railway openings have been numerous. About two years ago the opening to Hay, in the south-west, took place, and that was followed by the opening of the line to Boggabri, in the north-west. Then came the opening of the line to Uralla in the north, and after that the opening of the extensions to Narrabi in the north-west, Nevertire in the west, Armidale in the north, and Nyngan also in the west. Following upon these there was the junction of the New South Wales and Victorian railways at Albury, and then the opening of the railway extensions to Tarago in the south, Glen Innes in the north, Mudgee in the west, Byrock also in the west, and Jerilderie in the south. It is expected that in a little more than two years the railway system of this colony will be joined to that of Queensland, and that within

he same period the connecting link between the Great Southern and Great Northern railways will be completed. There will then be uninterrupted railway communication between the three capitals of Queensland, New South Wales, and Victoria; and as Victoria and South Australia are arranging to connect their railway systems, the four principal colonies will very soon be joined together, if not by a political and social federation, at least by those iron bands which largely promote trade, and in many other ways materially assist Australian progress.

THE LANCASHIRE IRON AND COAL TRADES DURING 1884.

The past 12 months have been a continuation of the depression which has characterised both the iron and the coal trades of this district for several years past, and the only variation has been that prices have touched a lower level than even during the preceding year. The volume of actual business doing, taking it all through, it is true has been fairly large, but supplies have always been in excess of requirements, with the result that competition has persistently kept prices extremely low.

In the Iron Trade the market all through the year has been almost unvaryingly in favour of the operations of "bear" speculators. Both in pig and manufactured iron there has from the commencement of the year to the close been a persistent downward movement in prices, which only in the case of Derbyshire and outside brands, such as Scotch and Middlesborough, has shown any recovery. At the commencement of the year the basis of prices for local and district brands of pig-iron was about 45s., less 2½, delivered equal to Manchester, but almost immediately a downward movement set in, which before the close of the month had brought down prices quite 6d. to 1s. per ton. The concessions offered by makers brought forward a moderate weight of buying, and for a month or so prices remained stationary, but directly the running out of contracts necessitated the seeking of new orders, still further concessions had to be made until by the end of the first half of the year prices had got down to about 42s. 6d. and 43s. less 2½. As it became evident that low prices failed to stimulate trade, the question of a reduction of the output as a preferable alternative to a forced business at unremunerative rates began to be considered by makers. Here and there furnaces in the district were either blown out or damped down with, however, no very perceptible effect being produced upon the market. Prices remained low, and where business had to be sought the downward movement continued, until in August, not only Lancashire and Lincolnshire iron, the two principal competing brands, but Derbyshire iron also could be got at from 41s. to 42s., less 2½ delivered equal to Manchester. Buyers and consumers were apparently tempted to place out some fairly large contracts at these figures, which were followed by the low quotations for Derbyshire being withdrawn, whilst in other brands some disposition was shown to hold out for 1s. per ton above the lowest prices that had been taken. Any actual advance was, however, only realised in exceptional cases, and for the last quarter of the year business has been extremely dull. The contracts placed during August have, as a rule, been more than sufficient to cover the requirements of consumers, many of whom have deliveries still to come in that will carry them well over the first two months of the present year.

Where consumers have wanted iron buying has chiefly gone on from hand to mouth, with a gradual easing down in prices to about 40s. to 41s for Lincolnshire, and 41s. to 41s. 6d., less 2½, for local brands, delivered into the Manchester district. In the finished iron trade manufacturers generally have been able to keep their forges fairly well employed through the year, but it has only been by constant concessions in price. There has been an absence of any pressure of orders in the market, and buyers have been able to force down prices gradually but steadily during the whole twelve months. The average basis of prices with which the year opened was about 6*l.* to 6*l.* 2s. 6d. for bars delivered into this district, but makers have had to follow a persistently falling market, until the year closes with prices fully 10s. per ton under the basis at which it opened, bars being now obtainable at 5*l.* 10s. to 5*l.* 11s. 3d. per ton delivered into the Manchester district. The hematite trade has been in a very depressed condition all through the year, and prices have touched a lower point than has probably ever been known, good foundry brands delivered into the Manchester district having been quoted at as low as 52s. per ton, less 2½. A little more animation has characterised the closing months of the year, and prices have shown a slight upward tendency, but it can scarcely be said that any very material advance has been actually established, except that sellers in some cases are not open to book within 1s. per ton of the lowest prices that have been taken during the year.

In the engineering trades the year opened with very fair prospects as far as nearly all branches, except shipbuilding, were concerned, and for the first half of the year a moderate amount of activity prevailed pretty generally. Even marine engine builders were kept fairly busy finishing work, which, however, not being replaced by new orders, they have in most cases since been left very slack. Locomotive builders have been well supplied with work all through the year, and although recently there has been a falling off in the weight of new orders coming forward, the year closes with the large private shops still well supplied with work. In the machine tool making trade the leading firms commenced the year with their shops generally well supplied with orders, and although not quite so busy with the close, fair enquiries still came forward, and there is sufficient work to keep them moderately employed. Cotton machinists have during the year had a tolerably large supply of work, and the large firms in the Oldham district have been kept busy. Stationary engine building and millwright work has been rather fluctuating, but still fairly good generally, and the large engineering firms have also been tolerably well employed—in fact, it may be said that apart from the depression resulting from the complete collapse of shipbuilding, the engineering trades of Lancashire have, during the year, held their own, and although employment certainly is not so good as at the commencement, there is no actually serious falling off in this direction the returns of the various Trades Union societies showing no exceptionally large number of men in receipt of out of work support with the close of the year, whilst, so far as wages are concerned these, except in the shipbuilding districts, have been maintained on the level of the advanced rates conceded during the previous year.

The Coal Trade has been characterised by a more or less depressed tone all through the year. The close of the previous year left prices on a moderate basis, following the advance which had been made at the commencement of the winter, and at the pit mouth best Wigan Arley was being quoted at 10s. 6d. to 11s. per ton; seconds and Pemberton Four-feet about 8s. 6d.; common house fire coal, 7s.; and steam and forge coal about 6s. to 6s. 6d. per ton. It was, however, very soon found that these prices could not be maintained; the exceptional mildness of the season caused house fire coal sales to fall rapidly to the level of an ordinary summer trade long before the winter months were over, and with the small requirements for house fire consumption accompanied by only a moderate demand for ironmaking and general trade purposes, round coals became a drug on the market, and prices got to quite as low a point as any they ever touched during the preceding year, whilst pits in most cases had to go on about half time.

With the exception of a slight improvement in the demand for house fire consumption during March and April, business continued to drag on from the winter to the summer months in a dull depressed manner, with a constant downward tendency in prices, until best Wigan Arley could be got at the pit mouth at from 8s. 6d. to 9s.; seconds coal at 6s. 6d. to 7s.; and common round coals at 5s. 6d. to 6s. per ton. With the commencement of the present winter season an attempt was made to bring prices back to something like the level at which they stood at the beginning of the year; but although a general advance of something like 1s. per ton was announced on round coal, this has been only very partially maintained, and the year closes with round coals fully 1s. to 1s. 3d. so far as the best sorts are concerned, and 6d. to 1s. per ton in other descriptions lower than they were at the same period last year. With the last week or so of the year the severe weather has brought about a rather more healthy tone, but it has not so far established any advance in prices, which close the year at about 9s. for best coal, 7s. 6d. for seconds, 6s. to 6s. 6d. for common sorts. With regard to the usual large contracts placed out during the year, it may be mentioned that in gas coal they averaged a little under the prices got in 1883, but there was decidedly less contracting for extended deliveries over two or three years, many of the colliery proprietors declining to go further than 12 months. The railway contracts for locomotive fuel were to a very large extent placed at about 5s. 6d. per ton for good qualities at the pit mouth. Prices for engine fuel have shown comparatively very little fluctuations during the year, the most noticeable featnre being the plentiful supplies of slack during the summer months. Burgy has not varied more than 4s. 6d. to 5s. per ton at the pit mouth, good slack has maintained an average of about 4s. to 4s. 3d., and common sorts about 2s. 6d. to 3s. per ton at the pit mouth. The question of wages has necessarily been a matter of serious consideration in face of the low prices ruling in the market. During the early portion of the year the men renewed their previous year's agitation for an advance. This, of course, had to be abandoned, and subsequently it was followed by the employers taking action to enforce a reduction of 10 per cent., which though not accepted by the men without some show of opposition did not meet with any serious resistance. With the close of the year preliminary arrangements have been set on foot for establishing a sliding-scale to regulate wages in the future, without recourse to the protracted strikes which have proved so disastrous to the trade of the district in the past. Only slow progress has so far been made in coming to an agreement between the employers and the men, but it is hoped that before long an amicable arrangement for regulating wages will be accepted by both sides.

NATURE'S HYGIENE.

The increased attention which has been given to sanitary matters during the past few years, and the circumstance that the regulation of them is still very frequently entrusted to men who have never studied anything connected with sanitation, and whose general education, moreover, has not been such as to be likely to prevent their falling into the gravest errors, add vastly to the necessity and utility of such works as that of Mr. KINGZETT, the second edition of which —Nature's Hygiene: A Systematic Manual of Natural Hygiene. Containing also an account of the Chemistry and Hygiene of the Eucalyptus and the Pine. By C. T. KINGZETT, F.I.C., F.C.S. London: Baillière, Tindall, and Cox, King William-street, Strand—has just been issued. It is true that Mr. Kingzett's book upsets many much-loved theories which have been adopted by many professional as well as non-professional men; but since he enables his readers to replace those theories by facts the importance of the work he has performed is evident. Take, for example, ozone, which a few years since was as familiar in the mouths of ladies as the most approved make of velveteen or the finest sealskin, and in high favour among medical men. With regard to it Mr. Kingzett says:—The majority of persons undoubtedly attach great importance to atmospheric ozone, and believe it to be the greatest purifying influence in Nature, many going so far as to assert that zymotic disease exhibits a definite relation to ozone in the sense that when ozone is absent from the atmosphere disease occurs and spreads, and that where present zymotic disease is almost unknown. It seems a vast pity to upset notions which have taken so deep a root in men's minds; but the truth must be told by scientific men, and the truth is that nearly all the observations which have been made on the subject are inconclusive. It was pleasant enough to resort annually to the seaside in the firm belief that there ozone occurred plentifully, and miasmatic poisons could not endure; but, as a matter of fact, there is little evidence to show that, so far at least as ozone is concerned, the seaside is any healthier than the flats and marshes of Lincolnshire or the hills of Devonshire.

And now one word in explanation. The chemical reagents and tests which have been applied by different observers in determining the presence and amount of ozone in the atmosphere under various circumstances are not alone influenced by ozone; they are also influenced by peroxide of hydrogen, and there is at present no reliable and practicable method for testing and estimating the one substance without including the other. There is generally some amount of truth in any doctrine or belief which may be held by a large number of persons, and as readers of the foregoing sentences may have suffered some discomfort in feeling that their pet theory was here demolished, it is pleasant to restore their comfort, and place it upon a more enduring basis. My readers, then, may rest content with the assurance that even if ozone does not occur in the air so freely as previously believed, yet another substance does, and one, too, of greater sanitary value—peroxide of hydrogen. Although it cannot be said with certainty that ozone ever occurs in the atmosphere at all, its presence in minute amount is very probable, and more particularly because there are times and conditions when ozone must presumably be produced in the atmosphere. It must yet be distinctly understood that there is no known test for ozone admitting of application which is not also affected by peroxide of hydrogen.

Few elements afford stronger evidence of the complicated and laborious nature of chemical investigation, and the consequent slowness of chemical discovery than ozone. Oxygen, or at least its existence, was discovered in 1674, and within ten years of its discovery Van Marum observed that upon this gas being subjected to the passage of electric sparks it acquired a peculiar fishy odour, and it is said that shortly afterwards Cavallo discovered its disinfecting value, and applied it as a remedy to foetid ulcers; yet the nature and properties of the gas has only become fairly known within the present generation. Mr. Kingzett states that in 1826 Dr. John Davy recognised the presence of a similar principle in the atmosphere, thus explaining the odour often referred to in history as having been observed during storms and periods of electrical disturbance. It was not, however, till 1839 that any precise knowledge was obtained regarding the substance in question. M. Schönbein, of Basle, who was then engaged in an investigation of the electrolytic decomposition of water, noticed the same odour in the apartment in which he conducted his experiments, and this led him to a prolonged research, having for its object the elucidation of the nature and properties of this gaseous principle, from which its odour he named "ozone." He ascertained that a certain amount of this substance is mixed with the oxygen which is evolved at the positive pole during the voltaic decomposition of water, and further observed a number of its oxidising effects. The nature of ozone proved a very hard nut for chemists to crack, and the task has only been accomplished by men now living.

In the same chapter Mr. Kingzett deals with nitrogen, carbonic dioxide, hydrogen, water, and peroxide of hydrogen, and explains their occurrence in Nature and their general properties. He then gives a chapter on the chemistry of the atmosphere, respiration, and ventilation; and this is followed by one on oxydation, physiological combustion, natural decay, and putrefaction, the sanitary bearings of these several processes being pointed out. In succeeding chapters water, water supply, sewage contamination, purification of water; the disposal of sewage and its treatment by irrigation and chemical processes; infectants and contagious diseases, and the theories of disease; antiseptics and disinfectants, and so on; whilst in the concluding chapter of the first part, in discussing the scientific basis of practical disinfection, he remarks that Klein is forced to admit that pathogenic organisms act, in all probability, by the production of chemical poisons; but there he stops short, and does not apparently see that if this be so then two further inferences must be made; in the first place, a pathogenic micro-organism can never exist apart from its virus, for its life function is identified with its production; secondly, since the virus is the true infectant three classes of chemical substances can be employed in the treatment and prevention of specific diseases—1. Substances (true disinfectants) which chemically change and destroy the virus.—2. Substances (antiseptics) which, by inhibition of the growth of the micro-organisms, prevent the production of the virus.—3. Substances (germicides) which may be proved to be fatal to micro-organisms and their spores, if such substances can be found. Germicides, if otherwise available, cannot be relied upon for the cure of diseases, for their introduction into the human body is as fatal to the host as to the parasites; and while they are equally poisonous as the true virus of any infectious disease, they may, for all that is known to the contrary, be without action upon the virus itself, even if the micro-organisms are killed off. In every sense, then, non-poisonous disinfectants of the two classes first-named are to be preferred both for the prevention and the cure of infectious diseases.

The second part of the volume treats of malarial fever and its cause, including an account of the sanitary properties of the eucalyptus and its products; essential oils and perfumes; antiseptic and disinfectant properties of the products of the atmospheric oxidation of essential oils, and the Sanitas disinfectants; and on pine and eucalyptus forests. Mr. Kingzett deals with every branch of his subject clearly, exhaustively, and in a style which not only shows his mastery of the subject himself, but his ability to impart his knowledge to those who have not had the benefit of scientific training. Few of those who carefully and thoughtfully read his book will, however, accept his opinion that great public benefit would result from the appointment of chemical officers to act in conjunction with medical officers of health. It is notorious no doubt that medical men and engineers are not qualified by their special education and training to deal with many questions which are of the greatest importance to public health and wealth; but this scarcely justifies his belief that the appointment of efficient chemists as officers to act under Sanitary Authorities and Local Boards would effect a saving for rate-payers generally. In this Mr. Kingzett is probably mistaken, since the bodies mentioned are as a rule far too thick-headed and conceited to accept any suggestion whatever from men practically acquainted with the subject upon which a decision has to be given. The preferable course would seem to be to compel sanitary authorities and local boards to consult efficient chemists when their assistance is required, and not accept as gospel the chemical views of some chattering tailor or parson who may happen to be a member of the board. It is not long since that a sanitary parson, scarcely a dozen miles from London, proposed to utilise the sewage by converting the solid portions into blacking and the liquid into ink; but he fortunately died before succeeding in getting his invention adopted at the expense of the ratepayers. Mr. Kingzett's book may be read with advantage and profit by all interested in sanitation, as it will give them an abundance of facts which will prevent their being misled by interested inventors, and enable them to give intelligent decisions upon many questions which are likely to come before them.

MAKING STEEL DIRECT FROM CAST-IRON.

Some improvements which apply to iron ore in its various forms when reduced and still in the crucible of the blast-furnace, to pig-iron in its various forms, and to scrap cast-iron in its innumerable qualities and kinds, have been patented by Mr. PATRICK BARRY, of Tottenham. He states that one and all of the forms, varieties, and kinds of iron mentioned admit of assuming the properties of steel in their existing or normal condition of crude iron. The definition of steel being that of a metal capable of retaining in low temperatures its natural or specific heat, and also capable of retaining measurable heat within the usual range of the utilities, as in tempering. These improvements take the new departure of imparting the properties of steel to cast-iron as such; steel making hitherto having taken the form of imparting the properties of steel to wrought-iron or to the equivalents of wrought-iron—to iron in a condition more or less susceptible of forging or drawing under the hammer. The improvements in this invention imparting the properties of steel to crude or cast-iron may in the case of the blast-furnace which has been used for the reduction of metallic iron ore conveniently take this form, the slag having been allowed to overflow, the steel converting material is thrown in the molten mass, and afterwards the molten mass is run into sows or pigs in the usual manner. The sows or pigs are now steel, in other words they are a hardenin and tempering metal.

In the same manner tram and other rails and wheels and telegraph posts may be run into sand moulds direct from the blast furnace, taking afterwards in the usual manner such temper as may be required. In the case of the ordinary cupola furnace, no alteration or special lining is required, and after the fire has been lighted and well heated by the blast, the converting material is thrown in upon the coke, and upon the converting material a layer of coke is thrown in; afterwards the iron is charged into the cupola in the ordinary manner. As to the improvements in their application to the production of tram-rails and plane-irons for cutting wood direct from the foundry cupola, he takes about 2 cwts. of No. 1 "Calder" or No. 1 "Carron" for common qualities; for superior qualities he takes about 2 cwts. of No. 2 "Cinderford," or No. 2 "Cleator," or other equivalent pig irons. The furnace being lighted in the ordinary way and well heated with the blast, he throws in 7 lbs. in weight of grain emery and 7 lbs. of black oxide of manganese, and, if great fluidity is required, 1 lb. of chloride of lead, separately or combined in any convenient form. Upon this converting material he throws the 2 cwts. of pig-iron, puts on the blast, and runs into green or dry sand moulds in the usual manner. The castings are then in a condition to be hardened and tempered in the usual manner of steel made from wrought-iron or its equivalents. This is an illustration of the invention of giving the properties of steel to crude or pig-iron, but he can make use of any metallic earth or metallic substance whose properties are harder than those of iron.

THE LONDON AMERICAN EXHIBITION.—The progress already made toward the organisation of the American Exhibition, to be held in London during next year, has been more satisfactory than the most sanguine could have anticipated; and it must be highly gratifying to all who take an interest in the project to find that the heartiest welcome is offered to those Americans who may take part in the Exhibition by Englishmen of all classes and in every part of the country. From the support which the enterprise has already received from American manufacturers and inventors, it is evident that numerous machines, products, and manufactures will be brought to the notice of English purchasers which have heretofore been unknown on the English market; but all the leaders of British industry have long since adopted the view that although foreign importations may slightly increase competition, there is always so much to be learned from rival manufacturers that any possible disadvantage is more than compensated. As there is no rule without an exception, so one dissentient has been found who prevents the warm reception promised being absolutely unanimous. This individual who is said to be an unsuccessful English inventor, himself expresses the fear that British interests would be jeopardised by extending to the American Exhibition the ordinary English rule, that showing an article or invention at an exhibition is not regarded as legal publication to the extent of preventing a patent being subsequently secured. It would perhaps be an indication of official courtesy if an American Exhibition were treated in the same way as an English exhibition would be; but it is really not a privilege worth asking for, since under the new English patent law the payment of 1*l.* secures the invention for nine months—a longer period than the Exhibition will remain open—and as the 1*l.* has to be paid on application for a patent anyway the privilege only amounts to giving the exhibitor six months' time to enable him to save up the 1*l.* fee demanded of him—a boon which will not be appreciated by Americans generally, whilst some might regard the offer of it as an insult rather than as a courtesy. The American Exhibition is likely to be a great success, and the fewer privileges (?) are offered to exhibitors the better they will be pleased.

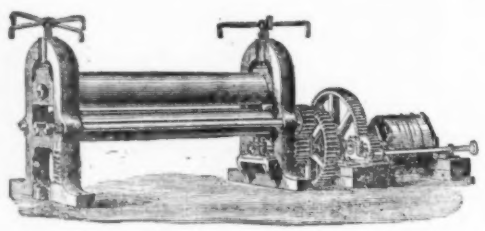
THE MAKE OF THOMAS-GILCHRIST STEEL IN 1884.—Authentic returns, just compiled, as to the make of THOMAS-GILCHRIST dephorphorised steel and ingot iron for the year ending Sept. 30 show that the process is making steady progress in this country, and more especially so on the Continent, the output having been 685,000 tons for the Continent, and 179,000 tons for England, or a combined total of 864,000 tons. This is an increase upon the previous year of nearly 250,000 tons. The total number of Bessemer and Siemens furnaces in operation on this process is nearly 80, and eight more are to be started early in the coming year. The most noteworthy feature about these figures is the evidence they give of the quicker appreciation of the process on the Continent.

TANGYES LIMITED, CORNWALL WORKS, BIRMINGHAM.

LONDON: 35, Queen Victoria Street. NEWCASTLE: St. Nicholas Buildings. MANCHESTER: Deansgate. GLASGOW: Argyle and Hope Streets.

(No. 23.)

PLATE STRAIGHTENING & BENDING ROLLS.



The above are suitable for Rolling complete rings; the top roll being easily removable.

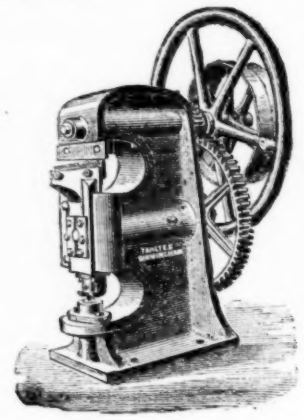
The Rolls can be arranged for angle or T iron, if required, at a slight extra cost.

The Price includes both Striking Gear and Foundation Bolts.

No.	To take plates.	Thickness of plates rolled cold.	Diam. of top roll.	Diam. of bottom rolls.	Approx. weight.	Price.	If arranged to bend L or T iron, extra.
1	6 ft. wide	⅜ in.	10 in.	8 in.	105 cwt.	£115	£10 0 0
2	7 „ „	⅜ „	10 „	8 „	115 „	155	10 0 0
3	7 „ „	½ „	12 „	10 „	130 „	190	10 0 0
4	9 „ „	½ „	13 „	10 „	195 „	295	15 0 0
5	9 „ „	½ „	14 „	10½ „	210 „	320	20 0 0

180

PUNCHING AND SHEARING MACHINE.

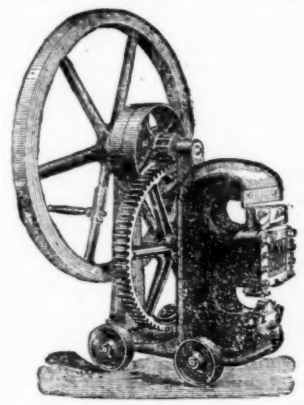


The Shear is placed at an angle for cutting off long bars.

No.	Will punch holes diam.	Through iron plates thick.	Will shear iron plates thick.	Distance from edge of plate. Shears.	Distance from edge of plate. Punch.	Approx. weight.	Price.
A	1 in.	1 in.	1 in.	13 in.	16 in.	95 cwt.	£110
B	¾ „	⅝ „	⅝ „	9 „	11 „	40 „	60
C	⅝ „	⅜ „	⅜ „	7 „	8 „	19 „	38
D	⅜ „	¼ „	¼ „	6 „	6 „	11 „	25

181

PUNCHING AND SHEARING MACHINE.



The Shear Blades are placed at an angle for cutting off long bars.

No.	Will punch holes diam.	Through iron plates thick.	Will shear iron plates thick.	Distance from edge of plate. Shears.	Distance from edge of plate. Punch.	Approx. weight cwts.	To work by power only.	To work by hand and power.	If mounted on four wheels. extra.
1	¾ in.	⅜ in.	⅜ in.	8 in.	8 in.	15	£30	£33	£2
2	⅞ „	½ „	½ „	10 „	8½ „	25	43	46	3
3	1 „	⅝ „	⅝ „	11 „	12 „	32	55	58	3
4	1¼ „	¾ „	¾ „	10 „	12 „	45	65	70	3
5	1 „	1 „	1 „	18 „	13 „	90	105	110	4

Punches and dies to punch under any of the sizes named, extra.

NOTE.—No. 5 machine is double geared.

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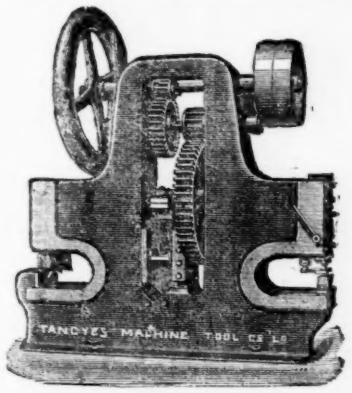
PUNCHING AND SHEARING MACHINE.



With disengaging motion for punching, handle on each side, and disengaging motion for angle iron.

No.	Will punch holes diam.	Through iron plates thick.	Will shear iron plates thick.	Distance from edge of plate.	Will shear angle iron.	Approx weight without angle iron shears.	Approx. weight with angle iron shears.	Price without angle iron shears.	Price with angle iron shears.	If with steam engine extra.
*0	¾ in.	¾ in.	¾ in.	16 in.	3×3×⅜	3 tons.	3½ tons	£90	£102	—
1	1 „	1 „	1 „	14 „	4×4×⅜	5 „	5½ „	132	144	£20
2	⅞ „	⅞ „	⅞ „	18 „	4×4×½	5½ „	6 „	144	156	20
3	1¼ „	1¼ „	1¼ „	18 „	6×6×1	6½ „	7¼ „	180	192	25
4	1 „	1 „	1 „	24 „	6×6×1	7½ „	7¾ „	192	204	25

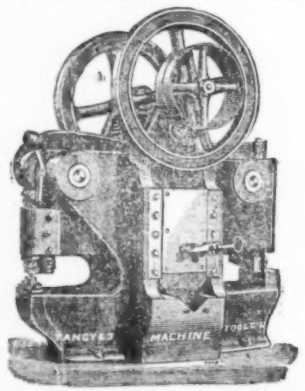
Punches and dies to punch under any of the sizes named, extra.

* This machine has single power gearing.

183

IMPROVED LEVER

PUNCHING AND SHEARING MACHINE.



The Levers are worked by cams, which allow the slide to remain at the top during half the revolution, giving ample time for adjusting the plate for the next hole. This Machine can consequently be worked at a quicker speed than the ordinary Eccentric Machines.

With Disengaging Motion for punching and for angle iron.

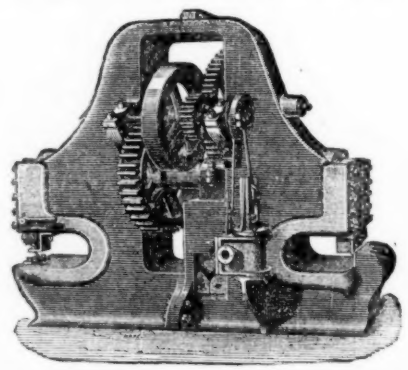
No.	Will punch holes diam.	Through iron plates thick.	Will shear iron plates thick.	Distance from edge of plate.	Will shear angle iron.	Price without angle iron shears.	If fitted with angle iron shears extra.
1	¼ in.	¾ in.	¾ in.	14 in.	3×3×⅜	£100	£20
2	1 „	1 „	1 „	18 „	4×4×⅜	130	25
3	1 „	1 „	1 „	24 „	4×4×½	220	25
4	1¼ „	1¼ „	1¼ „	24 „	6×6×¾	280	30
5	1½ „	1½ „	1½ „	30 „	6×6×1	380	30

Punches and Dies to punch under any of the sizes named, extra.

184

POWERFUL

PUNCHING AND SHEARING MACHINE.



With disengaging motion for punching, handle on each side, and disengaging motion for angle iron.

Will punch holes diam.	Through Iron Plates thick.	Will shear Iron Plates thick.	Distance from edge of Plate.	Will shear angle Iron.	Approx. weight with angle iron Shears and steam Cylinder.	Price without angle Iron Shears.	Price with angle Iron Shears.	If with steam Engine extra.
1¼ in.	1¼ in.	1¼ in.	26 in.	6×6×1	15 tons.	£330	£350	£30

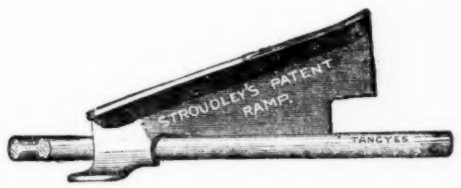
Punches and Dies to punch under any of the sizes named, extra.

185

TANGYES'

IMPROVED STROUDLEY'S RAMPS

For Re-railing Rolling Stock.



These Ramps greatly facilitate the placing of Rolling Stock on the Rail without injury to the Vehicles. They also lessen liability to accidents by the saving of time, and being light they are readily applied. They are supplied in sets of four—two right hand, and two left hand Ramps. The illustration represents one right hand Ramp in position on the rails for re-railing a Carriage, Goods Wagon, or Locomotive.

Size ..... No.	2	3	4
To re-rail	Ordinary Trucks.	Special Heavy Trucks	Locomotives.
Weight ..... each	84 lbs.	150 lbs.	180 lbs.
Price per set of Four Wrought-iron	£8 0 0	£12 0 0	£18 0 0
Steel	5 0 0	8 0 0	12 0 0

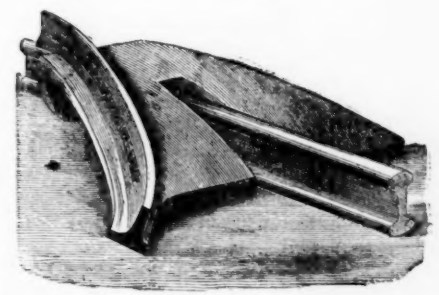
In ordering, a Section of the Rail used should be sent.

186

TANGYES'

DOUBLE RAILWAY RAMPS

For Re-railing Rolling Stock.



Size	A	B	C
To re-rail	Ordinary Trucks.	Special Heavy Trucks.	Locomotives.
Weight ..... each	150 lbs.	190 lbs.	240 lbs.
Price per pair— Wrought-iron... £	7 0 0	9 0 0	10 10 0
Steel ..... £	5 0 0	6 0 0	7 10 0

In ordering, a Section of Rail should be sent.

187

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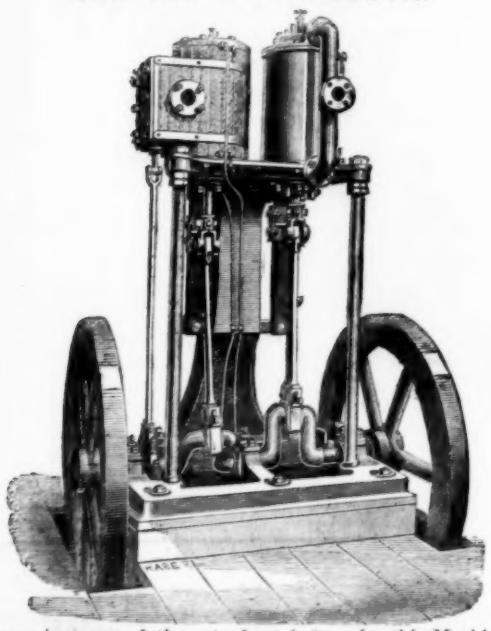
AND AIR COMPRESSOR.



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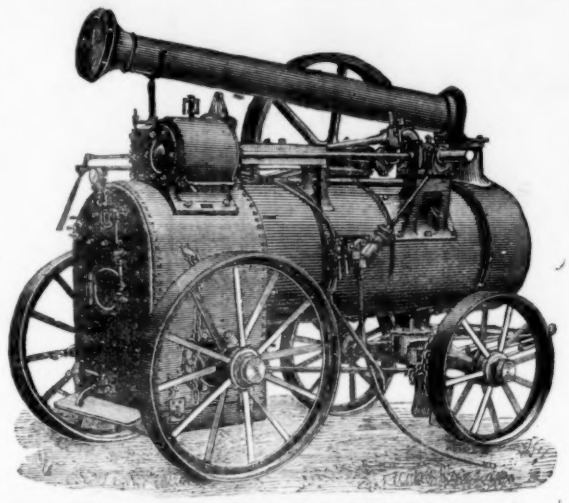

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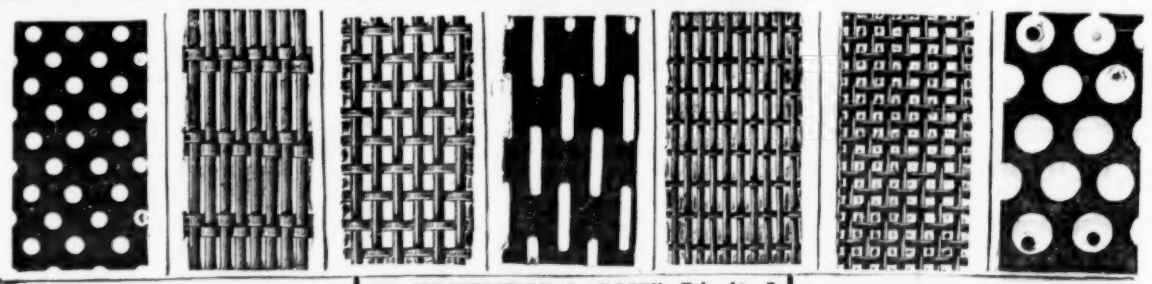

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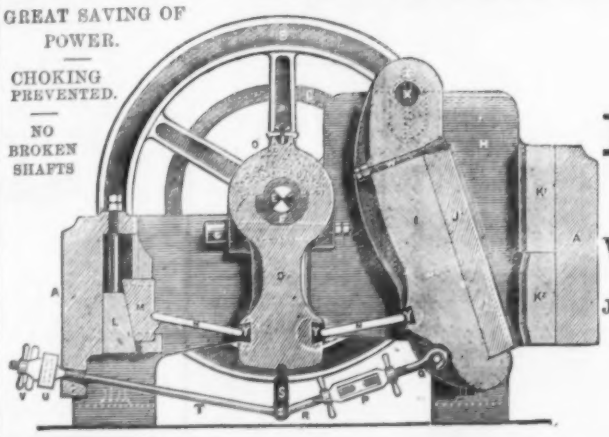

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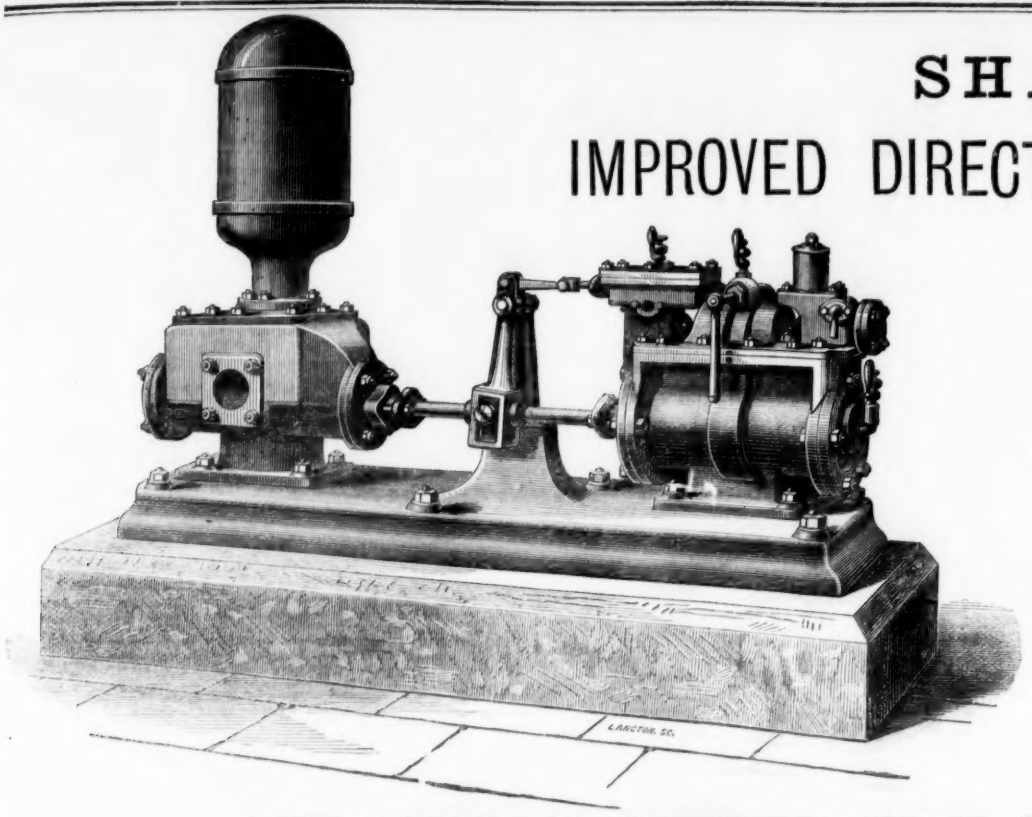

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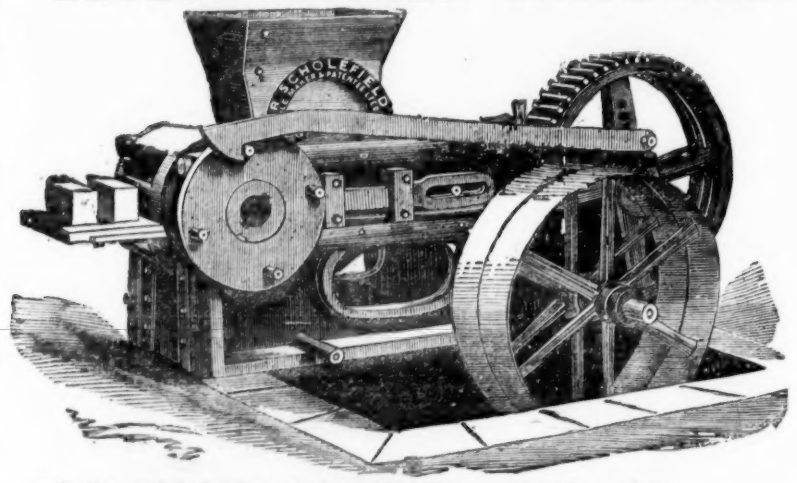

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1 engine-man, 5s. per day	0	5	0
1 man wheeling bricks from machine to kiln, 4s. per day	0	4	0
Total cost of making 10,000 pressed bricks	£1	5	0, or 2s. 6d. per 1000.

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As the above Machinery is particularly adapted for the using up of shale, bind, &c., it will be to the advantage of all Colliery Owners to adopt the use of said Brick-making Machinery.

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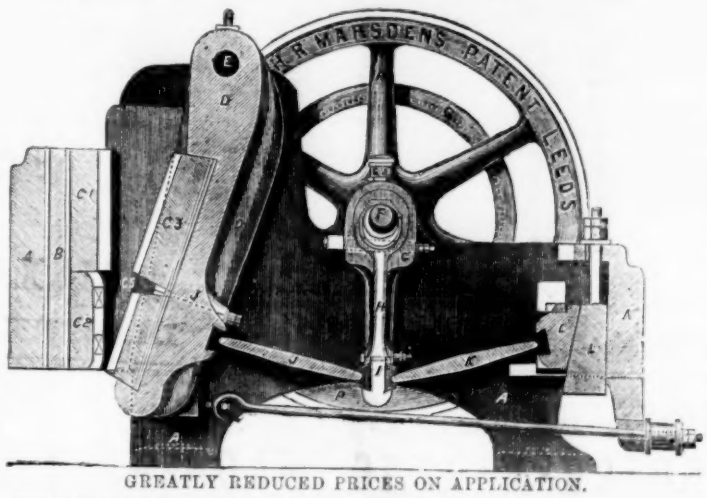

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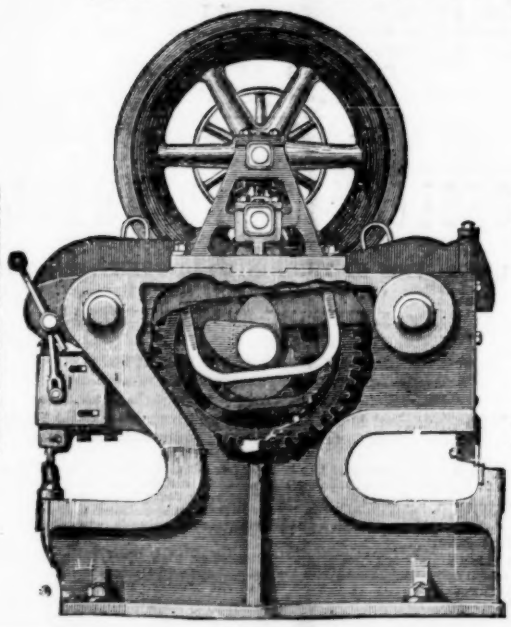

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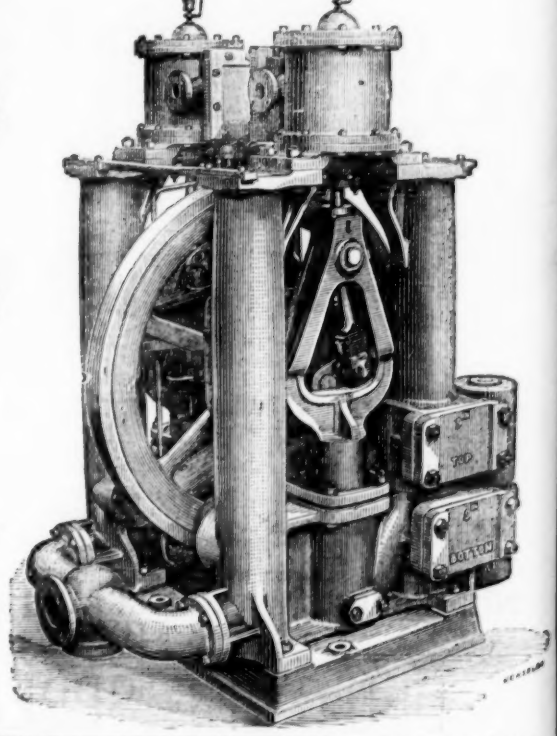

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